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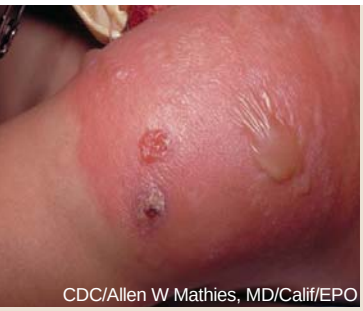
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Bacterial Skin Infections, Active Component, U.S. Armed Forces, 2000-2012

From 2000 through 2012, health care records of the Military Health System documented 998,671 incident cases of bacterial skin infections among active component members of the U.S. Armed Forces. Most cases (97.3%) were identified from records of outpatient medical encounters rather than hospitalizations. Cellulitis accounted for half (50.9%) of all cases of bacterial skin infection but 96 percent of associated hospital bed days. Of all cases, 42.3 percent were "other" skin infections (i.e., folliculitis, impetigo, pyoderma, pyogenic granuloma, other and unspecified infections). The remainder were attributable to carbuncles/furuncles (6.6%) and erysipelas (0.1%). Rates of infection were higher among female service members except for "other" skin infections. In general, the highest rates were associated with youth, recruit trainee status, and junior enlisted rank; however, rates of erysipelas were highest among those 50 years and older. Annual incidence rates of all bacterial skin infections have increased greatly since 2000. During the entire period, such infections required more than 1.4 million health care encounters and 94,000 hospital bed-days (equivalent to 257 years of lost duty time). The prevention, early diagnosis, and treatment of bacterial skin infections, particularly in high risk settings, deserve continued emphasis.

Bacterial skin infections are common in both general and military populations. Historically, skin infections, particularly of the feet, have had extreme detrimental effects on the military operational capabilities of ground combat units. For example, in World War I, prolonged standing in the cold muddy water in trenches produced mass casualties from "trench foot." The dirty, swollen, numb, poorly perfused, and often abraded feet of affected soldiers were susceptible to invasion by bacteria. Infantry soldiers in the front lines were most affected.[1]

During the Vietnam War, skin disorders, particularly bacterial skin infections that complicated immersion ("paddy") foot, were the leading cause of ambulatory visits and the third leading cause of hospitalizations of U.S. soldiers. Infantrymen conducting combat operations in inundated areas were most affected. Skin disorders overall accounted for 15 percent of all medical evacuations of U.S. soldiers from Vietnam.[2-4]

In recent times, outbreaks of cellulitis and other bacterial skin infections (including some caused by methicillin-resistant *Staphylococcus aureus* [MRSA]) have affected military recruits as well as experienced military members during physically rigorous training (e.g., Army Ranger, Navy SEAL).[5-11]

While most bacterial skin infections among previously healthy young adults have minor clinical effects and are easily treated, some bacterial skin infections of military members cause significant morbidity, disability, and degradation of military operational effectiveness, particularly if the infections are inappropriately treated, untreated, or resistant to commonly used antibiotics.

The clinical expressions of bacterial skin infections are diverse. Minor infections, such as impetigo and folliculitis, cause pustules or vesicles on skin surfaces or in hair follicles, and are generally caused by streptococcal or staphylococcal bacteria. Most cases of impetigo and folliculitis resolve after short courses of antibiotics.

Furuncles and carbuncles, also known as boils, occur when folliculitis progresses deeper into skin tissue and causes one (furuncle) or more (carbuncle) tender, swollen pustules. Furuncles and carbuncles can have systemic clinical manifestations such as fatigue and fever and can lead to sepsis. Furuncles and carbuncles often require surgical incision and drainage in addition to antibiotic treatment.

Erysipelas is an infection of the upper layers of the skin that is fiery red, painful, and has raised and sharply demarcated borders; erysipelas is almost exclusively caused by beta-hemolytic *Streptococcus*. Cellulitis is similar, but involves deeper skin tissue layers and has poorly demarcated borders. Cellulitis is most commonly caused by *Streptococcus* or *Staphylococcus*; however, gram-negative (e.g., *Klebsiella*, *Escherichia coli*, *Pseudomonas*) and anaerobic (e.g., *Clostridium*) organisms also can cause cellulitis.

Erysipelas and cellulitis often complicate breaks in the skin from trauma, burns, open blisters, or surgical wounds. The infections can have systemic effects such as fever, chills, and swollen lymph nodes. Mild infections are often treated with oral antibiotics; however, in severe cases, cellulitis may spread rapidly, cause significant disability, and require hospitalization for intravenous antibiotic therapy. Untreated cellulitis can progress to tissue necrosis, lymphangitis, necrotizing fasciitis, sepsis, toxic shock, and disseminated infections (e.g., meningitis).[12]

This report summarizes frequencies, rates, and trends of incident diagnoses of bacterial skin infections, overall and by type, among members of the active component of the U.S. Armed Forces. Skin infections occurring during deployments or requiring medical evacuations are summarized separately.

METHODS

The surveillance period was 1 January 2000 to 31 December 2012. The surveillance population included all U.S. members of the Army, Navy, Air Force, Marine Corps, and Coast Guard who served in the active component at any time during the surveillance period. The data used in this analysis were derived from the Defense Medical Surveillance System (DMSS), which maintains electronic records of all actively serving U.S. military members' hospitalizations and ambulatory visits in U.S. military and civilian (contracted/purchased care through the Military Health System) medical facilities worldwide. Diagnoses recorded in the combat theater of operations were derived from records of medical encounters of service members deployed to southwest Asia/Middle East that are documented in the Theater Medical Data Store (TMDS). TMDS data were available from 2005 to 2012.

For surveillance purposes, cases of bacterial skin infections were identified from records of hospitalizations and ambulatory visits that included diagnostic codes (ICD-9-CM) specific for bacterial skin infections **(Table 1)**. Incident cases of bacterial skin infections were defined by hospitalization records with case-defining diagnostic codes in the primary or secondary (first- or second-listed) diagnostic position or by ambulatory visit records with case-defining diagnostic codes in the first diagnostic position. An individual could account for multiple incident cases if there were more than 30 days between the dates of consecutive incident case-defining encounters.

Because bacterial skin infections can progress in clinical severity, case-defining diagnoses from hospitalization records were prioritized over those from outpatient records in characterizing incident cases. Also, case-defining diagnoses were prioritized by their presumed severity as follows: cellulitis, erysipelas, carbuncle/furuncle, and "other."

Medical evacuations for bacterial skin infections were estimated by identifying cases that were diagnosed from 5 days prior to 10 days after reported dates of medical evacuations from within to outside of the U.S. Central Command (CENTCOM).

Recruit/trainees were defined as such by identifying cases during recruit/training periods specific to each service at service-specific training locations.

TABLE 1. ICD-9-CM codes for skin infections

Skin infection	ICD-9-CM code
Cellulitis	681.x-682.x
Erysipelas	035
Carbuncle/furuncle	680.x
Other infections of skin and subcutaneous tissue[a]	684, 686.x, 704.8

[a]Impetigo, pyoderma, pyogenic granuloma, folliculitis, other and unspecified skin infections

RESULTS

During the 13-year surveillance period, there were 998,671 incident cases of bacterial skin infections among active component U.S. military members **(Table 2)**. Of

TABLE 2. Incident counts and incidence rates (per 10,000 person-years) of skin infections, by type and demographic/military characteristics, active component, U.S. Armed Forces, 2000-2012

	Cellulitis		Carbuncle/furuncle		Erysipelas		Other	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Total	508,635	274.0	66,322	35.7	1,064	0.6	422,650	227.7
Inpatient	24,859	13.4	339	0.2	134	0.1	855	0.5
Outpatient	483,776	260.6	65,983	35.6	930	0.5	421,795	227.3
Sex								
Male	426,256	268.7	52,312	33.0	886	0.6	386,240	243.4
Female	82,379	305.8	14,010	52.0	178	0.7	36,409	135.1
Race/ethnicity								
White,non-Hispanic	340,044	292.1	39,568	34.0	798	0.7	138,125	118.6
Black,non-Hispanic	78,581	246.7	14,951	46.9	90	0.3	222,846	699.5
Hispanic	48,031	252.4	6,411	33.7	100	0.5	32,822	172.5
Asian/Pacific Islander	14,322	197.5	1,957	27.0	30	0.4	6,578	90.7
Other/unknown	27,657	250.5	3,435	31.1	46	0.4	22,279	201.8
Age								
<20	78,585	458.4	8,186	47.7	91	0.5	51,492	300.3
20-29	287,374	282.5	38,899	38.2	542	0.5	265,083	260.6
30-39	102,957	207.8	14,155	28.6	269	0.5	80,099	161.7
40-49	36,078	227.1	4,662	29.3	137	0.9	24,002	151.1
50+	3,626	278.9	420	32.3	25	1.9	1,969	151.5
Service								
Army	199,082	299.3	31,748	47.7	412	0.6	152,627	229.4
Navy	102,599	227.3	12,566	27.8	189	0.4	99,321	220.0
Air Force	89,268	371.1	5,903	24.5	120	0.5	39,844	165.7
Marine Corps	102,936	229.9	14,282	31.9	320	0.7	120,674	269.6
Coast Guard	14,750	287.9	1,823	35.6	23	0.4	10,184	198.8
Status								
Recruit/trainee	35,657	984.6	1,765	48.7	18	0.5	29,342	810.2
Active duty (non-recruit)	472,978	259.9	64,557	35.5	1,046	0.6	393,308	216.1
Rank								
Junior enlisted	371,378	325.4	49,024	43.0	646	0.6	326,808	286.4
Senior enlisted	83,277	202.8	11,273	27.5	235	0.6	61,735	150.4
Junior officer	33,948	183.1	3,846	20.7	95	0.5	22,052	118.9
Senior officer	19,998	168.4	2,177	18.3	88	0.7	12,013	101.2
Occupation								
Combat-specific[a]	64,928	279.8	6,892	29.7	126	0.5	30,620	131.9
Armor/motor transport	22,717	282.9	3,023	37.7	31	0.4	17,927	223.3
Repair/engineering	12,269	177.3	1,212	17.5	41	0.6	6,821	98.6
Communications/intel	132,556	242.4	18,647	34.1	304	0.6	112,139	205.1
Health care	101,443	242.5	15,826	37.8	215	0.5	96,681	231.1
Other	40,044	264.6	6,101	40.3	123	0.8	43,356	286.5

[a]Infantry, artillery, combat engineering

FIGURE 1. Annual rates of incident inpatient encounters for bacterial skin infections by type, active component, U.S. Armed Forces, 2000-2012

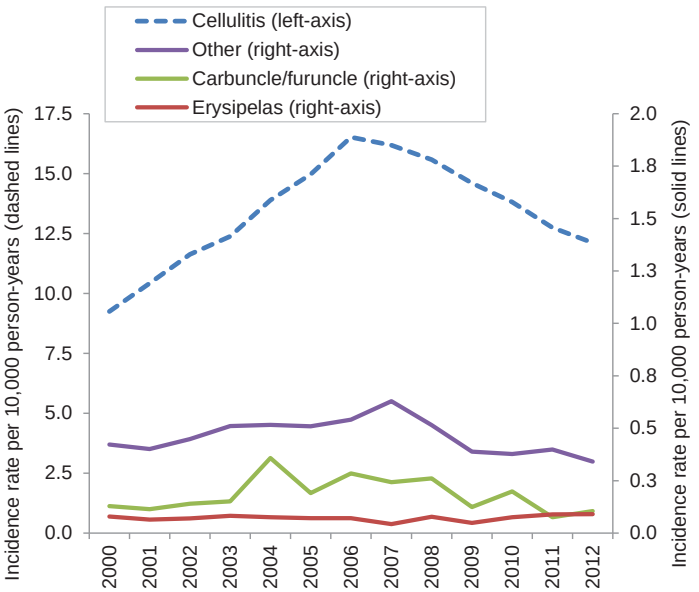
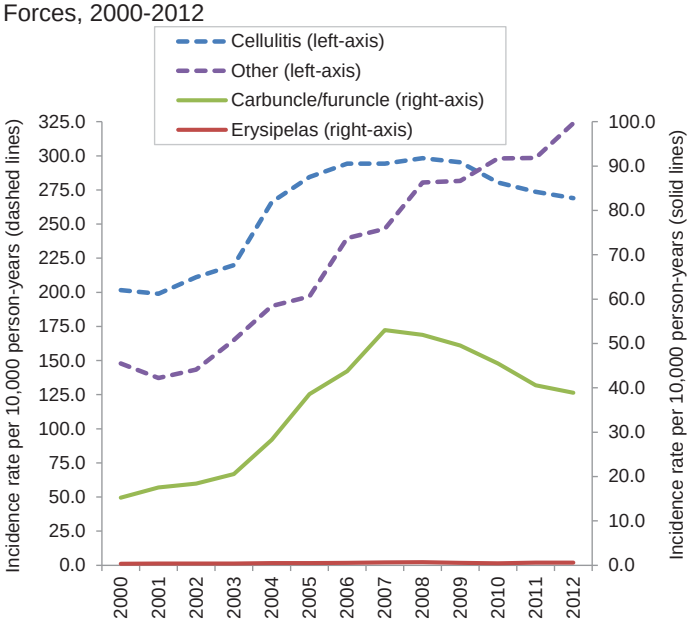


FIGURE 2. Annual rates of incident outpatient encounters for bacterial skin infections by type, active component, U.S. Armed Forces, 2000-2012



all incident case-defining diagnoses, half (50.9%) were cellulitis; 42.4 percent were "other" skin infections (e.g., folliculitis, impetigo); 6.6 percent were carbuncles/furuncles; and 0.1 percent were erysipelas. Most cases by far (97.3%) were identified from outpatient medical encounters. Cellulitis accounted for more hospitalized cases (n=24,859; 13.4 per 10,000 person-years [p-yrs]) than any other category of bacterial skin infections.

For all categories of bacterial skin infections except "other," rates were higher among females than males **(Table 2)**. Compared to their racial/ethnic counterparts, white, non-Hispanic service members had the highest rates of cellulitis and erysipelas and black, non-Hispanic service members had the highest rates of carbuncles/furuncles and "other" skin infections.

Rates of all categories of bacterial skin infections except erysipelas were highest among the youngest (<20 years) age group of service members; rates of erysipelas were highest among the oldest (≥50 years) service members **(Table 2)**. Compared to members of the other services, rates of cellulitis were highest among Air Force; rates of carbuncles/furuncles were highest among Army; and rates of erysipelas and "other" infections were highest among Marine Corps members.

For all categories of bacterial skin infections except erysipelas, rates were higher among recruits and other junior enlisted members than more senior enlisted members and officers.

Compared to their respective counterparts, the rate of cellulitis was highest among service members in armor/motor transport and combat-specific occupations; the rate of carbuncle/furuncle was highest among those in armor/motor transport and healthcare occupations; and rates of erysipelas and "other" skin infections were highest among those in "other" occupations **(Table 1)**.

During each year of the surveillance period and overall, cellulitis accounted for more hospitalized cases of bacterial skin infections than the three other bacterial skin infection types combined **(Figure 1)**. Annual rates of cellulitis-associated hospitalizations sharply increased from 2000 (9.3 per 10,000 p-yrs) to 2006 (16.5 per 10,000 p-yrs), and then steadily decreased to 2012 (12.1 per 10,000 p-yrs). Compared to cellulitis rates, rates of hospitalization for the three other skin infection types remained relatively low and stable throughout the period.

Overall and each year from 2000 to 2009, more incident cases of cellulitis than any one of the other bacterial skin infection types were treated in outpatient settings; however, during the last three years of the period, there were more outpatient treated cases of "other" skin infections than cellulitis or any one of the other bacterial skin infection types **(Figure 2)**. From the beginning to the end of the period, annual incidence rates of all types of bacterial skin infections treated in outpatient settings markedly increased (% change in annual rates, 2000-2012: cellulitis +33.4%, carbuncle/furuncle +155.4%, erysipelas +74.1%, and "other" +119.1%).

Body site

Of cases of cellulitis and carbuncle/furuncle for which an affected body site was identified (per ICD-9-CM diagnostic code) (n=409,427), the lower extremity was most frequently affected (40.3%); infections of the lower extremity were similarly distributed between the leg (22.3% of all cases) and foot/toe (18% of all cases) **(data not shown)**. Upper extremities were affected in nearly one-third (29.8%) of all cases with reported sites of infection; infections of upper

FIGURE 3a. Number of skin infections by type and time in service (months 0-24), active component, U.S. Army, 2000-2012

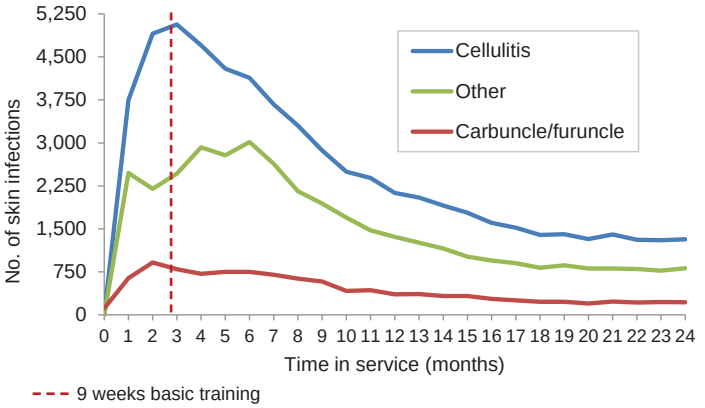


FIGURE 3b. Number of skin infections by type and time in service (months 0-24), active component, U.S. Navy, 2000-2012

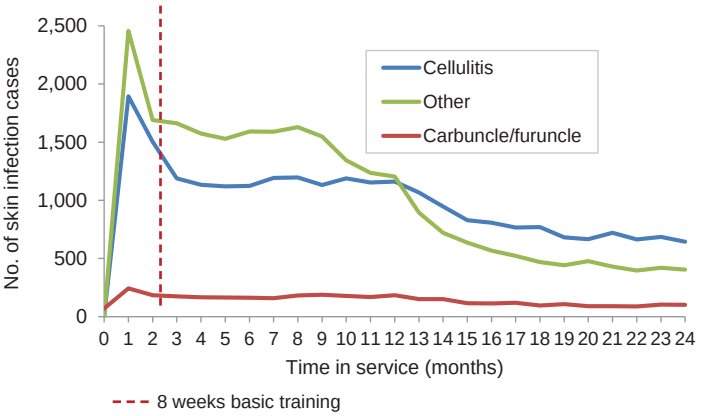


FIGURE 3c. Number of skin infections by type and time in service (months 0-24), active component, U.S. Air Force, 2000-2012

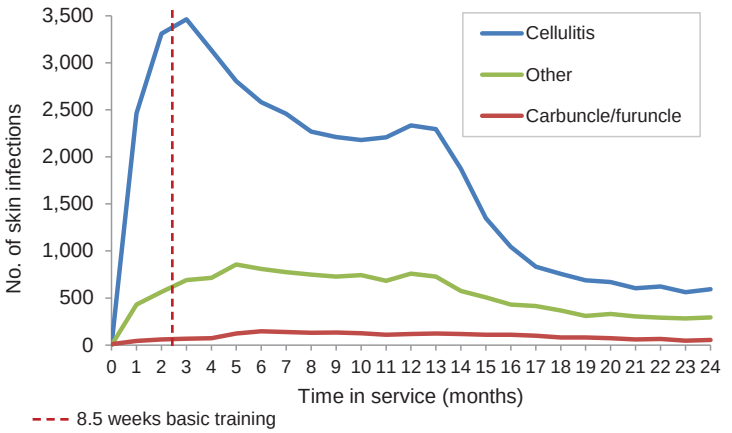


FIGURE 3d. Number of skin infections by type and time in service (months 0-24), active component, U.S. Marine Corps, 2000-2012

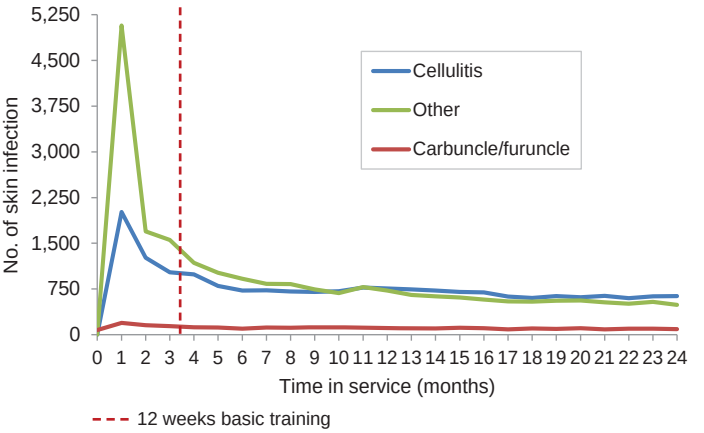
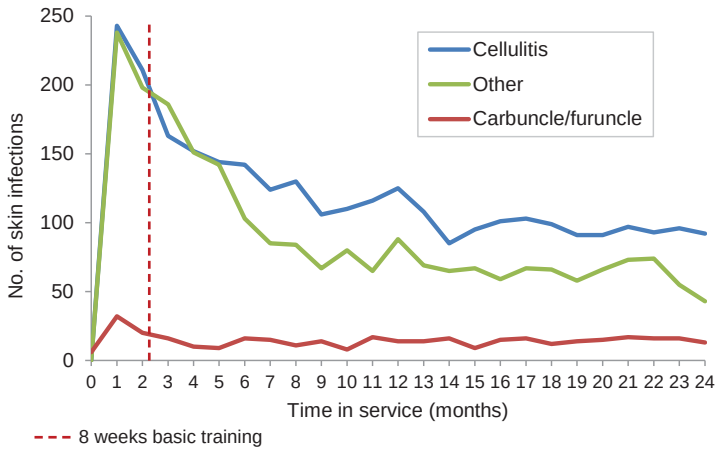


FIGURE 3e. Number of skin infections by type and time in service (months 0-24), active component, U.S. Coast Guard, 2000-2012

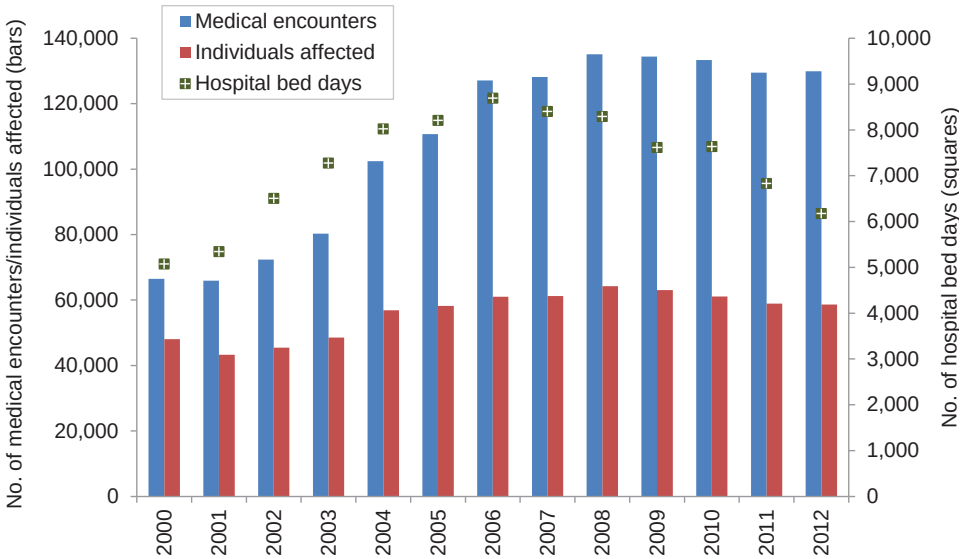


extremities were equally distributed between the arm (14.9%) and hand/finger (14.9%). Other sites affected by bacterial skin infections were the trunk (including buttock) (16.0%); face (7.1%); head/scalp (3.9%); and neck (2.9%) **(data not shown)**.

Time in service

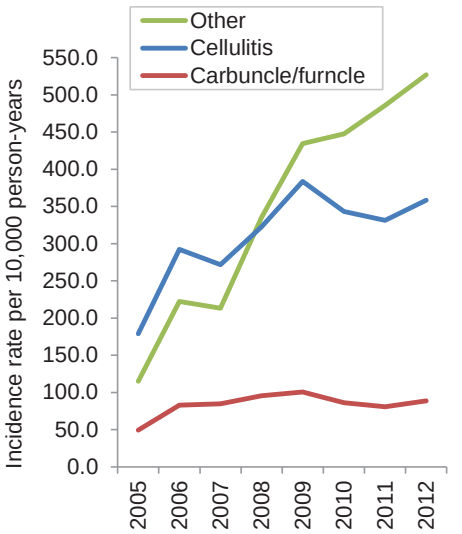
Among members of each service branch, there were peaks in the numbers of diagnoses of bacterial skin infections during the first three months of military service; typically, this is the period of recruit/basic training. In the Army and Air Force, cellulitis was the most frequently diagnosed skin infection type; cellulitis cases peaked during the third month of military service. In the Navy and Marine Corps, "other" bacterial skin infections were the most frequently diagnosed type **(Figures 3a-e)**. In the Navy, Marine Corps and Coast Guard, bacterial skin infections of all types peaked during the first month of service.

FIGURE 4. Numbers of medical encounters,[a] individuals affected,[b] and hospital bed days for bacterial skin infections, active component, U.S. Armed Forces, 2000-2012



[a]Medical encounters: total hospitalizations and ambulatory visits with an ICD-9 code for bacterial skin infection in the primary diagnostic position (with no more than one encounter per individual per day).
[b]Individuals with at least one hospitalization or ambulatory visit for the condition.

FIGURE 5. Incidence rates of bacterial skin infections during deployment to operational theater, active component, U.S. Armed Forces, 2005-2012



Burden of disease

During the 13-year surveillance period, 728,616 service members were treated for bacterial skin infections; the infections accounted for 1,415,806 medical encounters and 94,050 hospital bed days **(Figure 4)**. Annual numbers of medical encounters and individuals affected increased 51 percent and 34 percent, respectively, from 2000 to 2008, and then remained relatively stable through 2012. During the first two years of the surveillance period, on average, there were 1.9 medical encounters per individual affected. During the last three years of the period, there were 2.2 medical encounters per individual affected.

Annual numbers of bed days increased 71 percent from 2000 (n=5,071) to 2006 (n=8,691), and then decreased 29 percent through 2012 (n=6,171) **(Figure 4)**. During the surveillance period overall, cellulitis accounted for majorities of all bacterial skin infection-related medical encounters (59.3%), individuals affected (56.1%), and hospital bed days (96.3%) **(data not shown)**.

Skin infections during deployment

From 2005 to 2012, there were 90,102 bacterial skin infections diagnosed during medical encounters of service members in combat operational theaters. "Other" skin infections (46.3%) and cellulitis (42.1%) were the most frequently reported infection types; carbuncles/furuncles (11.5%) and erysipelas (0.2%) were less frequently reported **(data not shown)**. During the 8-year period, rates of documented bacterial skin infections of all types markedly increased **(Figure 5)**.

From 2005 to 2012, there were 109 medical evacuations from wartime theaters for skin infections. Cellulitis accounted for most such evacuations (n=92; 84.4%); "other" skin infections (n=14; 12.8%) and carbuncles/furuncles (n=3; 2.8%) accounted for relatively few, and erysipelas did not account for any medical evacuations out of the operational theater **(data not shown)**.

EDITORIAL COMMENT

Historically, military members, and particularly recruits/basic trainees and ground combat troops, have been at high risk of bacterial skin infections.[1-11] Often, military members must live, train, and operate in close quarters and harsh environments; sometimes, military members share equipment, articles of clothing, and personal items (e.g., soap, towels, blankets). During rigorous physical activities (e.g., obstacle courses, road marches), field training exercises, and combat operations, military members are highly susceptible to minor traumatic injuries (e.g., friction blisters, abrasions, cuts, and scrapes) which increase susceptibility to skin and soft tissue bacterial infections.

The rate of "other" skin infections among black, non-Hispanic service members was nearly six times higher than that of white, non-Hispanic service members. ICD-9 code 704.8 "other specified diseases of hair and hair follicles," which is in the "other" skin category, includes a specific type of facial folliculitis associated with shaving called pseudofolliculitis barbae. Pseudofolliculitis barbae occurs more commonly among black, non-Hispanics and other individuals with tightly curved and coarse hair.[13] Because servicemen are

required to be clean-shaven, it is not unexpected that the rates of "other" skin infections in this report are much higher among black, non-Hispanic servicemen.

This report reiterates the significant impacts of bacterial skin infections on the overall health of service members, their military operational effectiveness, and the Military Health System. For example, during the 13-year period reviewed for this report, nearly one million clinically significant bacterial skin infections affected more than 700,000 active component members. Evaluation and treatment of the infections required more than 1.4 million encounters with health care providers and more than 94,000 hospital bed-days (equivalent to more than 257 years of duty time lost during hospitalizations). In each of the Services, skin infections occurred most frequently by far during the first few months of recruit/basic training. In addition, among U.S. military members in war zones, more than 90,000 bacterial skin infections were documented in the past eight years; annual rates of diagnoses markedly increased throughout the period; and 109 service members were medically evacuated from the war zone for evaluation and treatment of skin infections.

The long history of the military operational significance of skin infections, the high health care costs associated with evaluating and treating skin infections, and the U.S. military's recent experience with skin infections in general and antibiotic resistant infections in particular highlight the importance of prevention, early diagnosis, and definitive treatment of skin infections – particularly in high risk settings such as recruit/basic training and special operations training. The design and execution of research, education, and training programs that are focused on the prevention, early diagnosis, and definitive treatment of bacterial skin infections should be high priorities. Specific recommendations to prevent, evaluate, diagnose, and treat MRSA infections in U.S. military populations are summarized at: http://www.med.navy.mil/sites/nmcphc/Documents/program-and-policy-support/MRSA_Guideline_AUG06.pdf.

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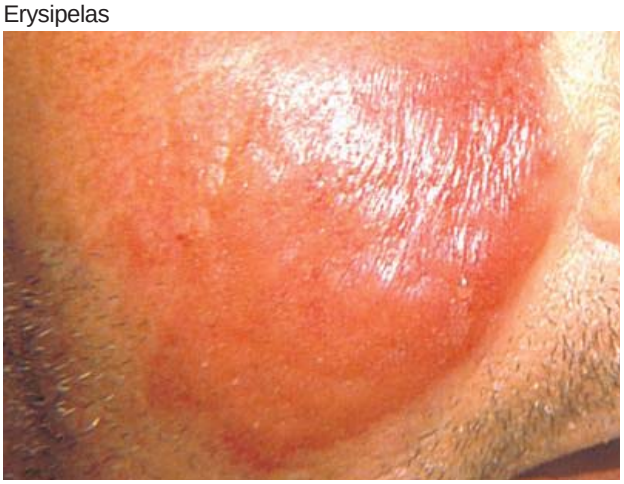
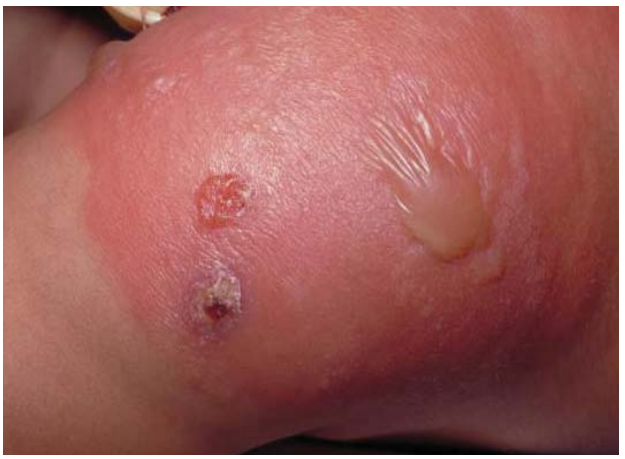
ERYSIPELAS VS. CELLULITIS. Erysipelas, an infection of the upper skin layers, is characterized by sharply demarcated borders. Cellulitis has poorly demarcated borders and involves deeper layers of the skin.

Erysipelas



CDC/Dr. Thomas F. Sellers/Emory University

Cellulitis



CDC/Allen W Mathies, MD/Calif/EPO

Pilonidal Cysts, Active Component, U.S. Armed Forces, 2000-2012

Pilonidal cysts affect mainly young adults and prompted hospitalization for nearly eighty thousand U.S. soldiers during World War II. During the surveillance period of 2000 through 2012, there were 35,517 incident cases of pilonidal cyst among active component U.S. service members. Of cases arising in non-deployed service members (n=32,134), 6.7 percent (n=2,175) required hospitalization for care. The overall incidence rate was 1.9 cases per 1,000 person-years (p-yrs). Annual incidence rates of hospitalized and outpatient diagnoses of pilonidal cyst were stable during the period. Approximately 11 percent of incident cases suffered recurrences. Although pilonidal cyst is said to affect males more commonly than females, the incidence rates among male and female service members were similar (1.9 and 1.7 per 1,000 p-yrs, respectively). The proportion of female cases who later developed recurrent disease (11.7%) was higher than that of males (10.9%). Incidence rates decreased with advancing age, and rates were highest in recruits and junior enlisted service members compared to their respective counterparts. On average, there were 800 hospital bed days and 1,731 days of lost duty time each year associated with the diagnosis and treatment of pilonidal cysts.

A pilonidal sinus is a channel or cavity that forms within the skin and subcutaneous tissue near the coccyx and has one or more openings to the skin surface near the natal cleft of the buttocks. It is believed that, in this anatomical region, pilonidal sinuses are caused by irritation from prolonged sitting, excessive sweating, and/or excessive hair growth – factors that may then cause the sinus to become clogged and infected. An infected pilonidal sinus may progress to an abscess, or pilonidal cyst, which is often very painful, swollen, and tender, and may drain fluid. Treatment includes antibiotics and/or incision and drainage of the pilonidal cyst; in cases in which the cyst recurs, surgical removal of the entire pilonidal sinus may be indicated. Surgical excision may require lengthy hospital stays and healing time and does not guarantee a complete cure of pilonidal disease.[1,2]

Pilonidal cysts are common among young men and may be associated with body changes during puberty such as the development of body hair and increased glandular activity of the skin (and resultant acne).[3] Inadequate personal hygiene, obesity, sedentary occupations (i.e., drivers or desk workers), type and amount of body hair, and family history are risk factors for pilonidal disease.[2-6]

Pilonidal cysts are a well-known problem among U.S. service members.[1,7,8] During a five-year period during World War II, nearly eighty thousand soldiers required lengthy hospitalizations to repair pilonidal cysts.[7] The etiology of pilonidal sinus disease during this period was attributed to lengthy, bumpy rides in the hard seats of military vehicles – specifically, Jeeps – causing irritation and pressure on the coccyx and thus was coined the term "Jeep seat disease."[7]

Pilonidal cysts continue to cause morbidity among U.S. service members. In 2012, 151 service members were hospitalized for pilonidal cysts and this condition ranked second to cellulitis among skin disorder hospitalizations.[9] Due to the disability associated with acute disease, the prolonged healing time associated with treatment, and the high recurrence rate of the condition, the impact of pilonidal cysts on the operational readiness and effectiveness of the U.S. military may be significant.

This report summarizes the counts, rates, and trends of pilonidal cysts among active component service members and describes the demographic and military characteristics associated with the disease.

METHODS

The surveillance period was 1 January 2000 to 31 December 2012. The surveillance population included all U.S. service members of the Army, Navy, Air Force, Marine Corps, and Coast Guard who served in the active component at any time during the surveillance period. The data used in this analysis were derived from the Defense Medical Surveillance System (DMSS), which maintains electronic records of all actively serving U.S. military members' hospitalizations and ambulatory visits in U.S. military and civilian (contracted/purchased care through the Military Health System) medical facilities worldwide. Diagnoses recorded in the combat theater of operations were derived from records of medical encounters of service members deployed to southwest Asia/Middle East that are documented in the Theater Medical Data Store (TMDS). TMDS data were available from 2005 to 2012.

Cases of pilonidal cysts were identified from medical records of hospitalizations and ambulatory visits that included a diagnostic code of 685, 685.0, or 685.1, "pilonidal cyst." For surveillance purposes, an incident case of pilonidal cyst was defined by a case-defining diagnosis in either the first or second diagnostic position of a hospitalization record or in the first diagnostic position of an outpatient record. An individual was counted as an incident case only once during the surveillance period. In a supplementary analysis, "recurrent" cases were defined and counted among service

"JEEP SEAT DISEASE" In the World War II era Jeep, the driver sat with the thighs flexed forcing the sacral region into the canvas seat.[5] The basic suspension of the vehicle and travel over rough terrain caused excessive friction – factors believed to lead to pilonidal cyst formation.

members only if more than 365 days had elapsed since any prior encounters in which the diagnoses were recorded.

Medical evacuations for pilonidal cysts were estimated by ascertaining cases diagnosed from 5 days prior to 10 days after reported medical evacuations from the U.S. Central Command (CENTCOM) to locations other than CENTCOM. Records of all medical evacuations conducted by the U.S. Transportation Command (TRANSCOM) are routinely collected for health surveillance purposes by the Armed Forces Health Surveillance Center. For this analysis, only evacuations during the years 2005 through 2012 were examined.

The annual "morbidity burdens" attributable to pilonidal cysts were estimated based on the annual total number of medical encounters attributable to the diagnosis (i.e., total hospitalizations and ambulatory visits for pilonidal cyst in the primary diagnostic position with a limit of one encounter per individual per day); numbers of service members affected (i.e., individuals with at least one medical encounter for pilonidal cyst during the year); total bed days during hospitalizations; and total number of lost duty days due to the condition. This fourth measure represents the days of work time lost due to hospitalizations plus one day for each "sick in quarters" disposition and one-half day for each "limited duty" disposition that resulted from ambulatory visits for pilonidal cyst. Although the calculated incidence rates of pilonidal cysts were based upon both DMSS and TMDS records, the morbidity burdens were based solely on diagnoses recorded in DMSS, reflecting care provided in the fixed health care facilities of the Military Health System.

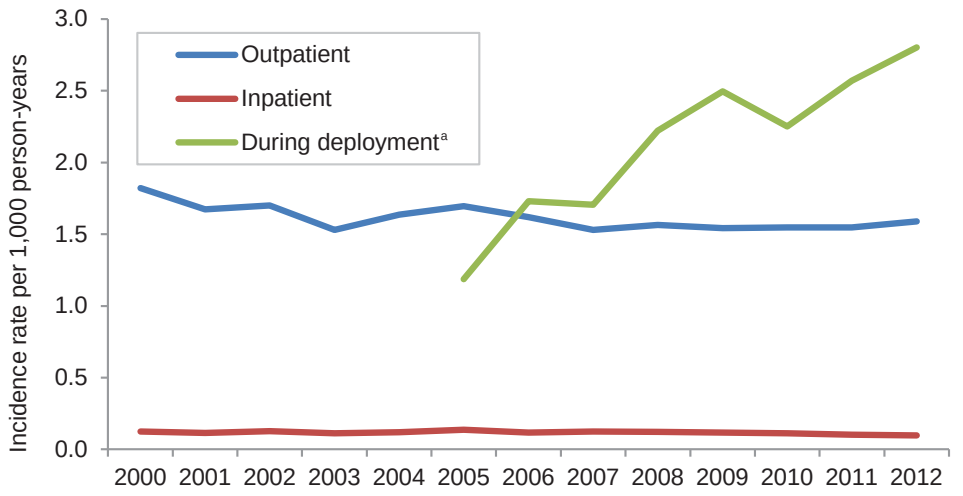
RESULTS

During the 13-year surveillance period, 35,517 individuals were identified as incident cases of pilonidal cyst among active component service members. Of these, 90.5 percent (n=32,134) occurred outside of the deployed setting. Of the non-deployed cases, 6.7 percent (n=2,175) were hospitalized cases; the rate of hospitalizations remained stable at 0.1 per 1,000 person-years (p-yrs) during the period **(Figure 1)**. The remaining 29,959 were outpatient cases; the rate of outpatient cases remained relatively stable during the period with an overall rate of 1.6 per 1,000 p-yrs.

From 2005 to 2012, 3,383 cases of pilonidal cysts were diagnosed during deployment to an operational theater. The overall incidence rate was 2.1 per 1,000 p-yrs; however, the incidence rate more than doubled from 2005 (rate: 1.2 per 1,000 p-yrs) to 2012 (rate: 2.8 per 1,000 p-yrs) **(Figure 1)**. During the same period, 53 service members were medically evacuated from the deployed setting for pilonidal cyst **(data not shown)**.

Of the total incident cases, 11.0 percent (n=3,906) subsequently met the case definition for recurrent pilonidal cyst one year or more after their initial encounter **(Table**

FIGURE 1. Annual rates of pilonidal cysts, active component, U.S. Armed Forces, 2000-2012



[a]Deployment data was available from 2005-2012

1). Among individuals who were hospitalized for pilonidal cyst, 7.8 percent (n=196) had more than one hospitalization (range: 2 to 6 hospitalizations) **(data not shown)**.

Among all cases, the incidence rate among males was higher than females (incidence rate ratio [IRR]: 1.1 male to female); however, a slightly greater percentage of females were recurrent cases (11.7%) than males (10.9%). White, non-Hispanic service members had the highest incidence rate while the lowest was among Asian/Pacific Islanders (IRR: 3.3 white, non-Hispanic to Asian/Pacific Islander) **(Table 1)**.

TABLE 1. Counts and rates of incident cases of pilonidal cyst (per 1,000 person-years) and counts of recurrent pilonidal cyst by demographic/military characteristics, active component, U.S. Armed Forces, 2000-2012

	Incident cases[a]			Recurrent cases[b]	
	No.	Rate	Incidence rate ratio	No.	%[c]
Total	35,517	1.9	.	3,906	11.0
Sex					
Male	30,887	1.9	1.1	3,364	10.9
Female	4,630	1.7	Ref	542	11.7
Race/ethnicity					
White, non-Hispanic	25,854	2.2	3.3	2,885	11.2
Black, non-Hispanic	4,022	1.3	1.9	464	11.5
Hispanic	3,286	1.7	2.6	339	10.3
Asian/Pacific Islander	482	0.7	Ref	29	6.0
Other/unknown	1,873	1.7	2.6	189	10.1
Age					
<20	3,717	2.2	2.7	14	0.4
20-24	17,588	2.8	3.5	1,527	8.7
25-29	7,942	2.0	2.5	1,381	17.4
30-34	3,212	1.2	1.5	577	18.0
35-39	1,826	0.8	Ref	278	15.2
40+	1,232	0.7	Ref	129	10.5
Service					
Army	12,643	1.9	1.2	1,346	10.6
Navy	9,482	2.1	1.3	1,046	11.0
Air Force	5,429	2.3	1.4	460	8.5
Marine Corps	6,995	1.6	Ref	920	13.2
Coast Guard	968	1.9	1.2	134	13.8
Status					
Recruit/trainee	888	2.8	1.5	0	0.0
Active duty (non-recruit)	34,629	1.9	Ref	3,906	11.3
Rank					
Junior enlisted	28,710	2.5	4.9	2,873	10.0
Senior enlisted	3,993	1.0	1.9	717	18.0
Junior officer	2,200	1.2	2.3	256	11.6
Senior officer	611	0.5	Ref	60	9.8
Occupation					
Combat-specific[d]	4,569	2.0	1.6	460	10.1
Armor/motor transport	1,862	2.3	1.9	213	11.4
Pilot/aircrew	849	1.2	Ref	98	11.5
Repair/engineering	11,524	2.1	1.7	1,399	12.1
Communications/intelligence	7,181	1.7	0.6	904	12.6
Health care	2,364	1.6	0.7	292	12.4
Other	7,168	2.0	0.8	540	7.5

[a]An individual could be counted as an incident case once during the surveillance period.
[b]A recurrent case was an individual who met the case definition for an incident case and did so again after a 365 day encounter free period.
[c]Percent of incident cases who were subsequently identified as recurrent cases.
[d]Infantry, artillery, combat engineering.

Black, non-Hispanic service members had the greatest percentage of recurrent cases (11.5%). Incidence rates decreased with increasing age. Service members in the Air Force, recruits, and junior enlisted ranks had higher rates compared to their respective counterparts.

By occupation, service members in armor/motor transport had the highest overall rate (2.3 per 1,000 p-yrs) **(Table 1)**. However, in the deployed setting, the rate among service members in repair/engineering occupations was the highest (3.0 per 1,000 p-yrs); the deployed rate was 59.9 percent higher compared to the non-deployed rate (1.9 per 1,000 p-yrs) among repair/engineering occupations **(data not shown)**. The rate among armor/motor transport cases occurring in deployment (2.7 per 1,000 p-yrs) was 35.0 percent higher than the rate among armor/motor transport cases occurring outside of deployment (2.0 per 1,000 p-yrs). The incidence rate among combat-specific occupations in the deployed setting (1.5 per 1,000 p-yrs) was 13.6 percent less than the rate in the non-deployed setting (1.7 per 1,000 p-yrs).

Burden of disease

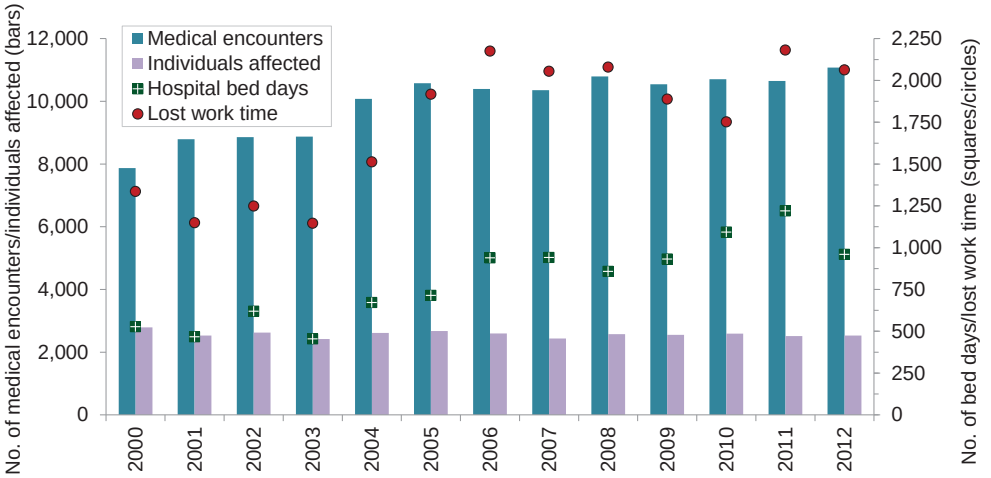
During the period there were 129,575 medical encounters in fixed medical facilities for pilonidal cysts among 33,444 individuals affected **(Figure 2)**. The annual number of medical encounters increased by 40.7 percent from 2000 to 2012; however, the number of individuals affected per year decreased by 9.5 percent. In 2000, on average, there were 2.8 medical encounters per individual. This number increased 55.5 percent to 4.4 medical encounters per individual in 2012.

On average there were 800 hospital bed days and 1,731 days of lost work time each year for pilonidal cysts **(Figure 2)**. Hospital bed days increased 82.2 percent and lost work time days increased by 54.0 percent during the 13-year period.

EDITORIAL COMMENT

Given that youth and male gender are recognized risk factors for pilonidal cysts, it is not surprising that many service

FIGURE 2. Numbers of medical encounters,[a] individuals affected,[b] hospital bed days, and lost work time days[c] for pilonidal cysts, active component, U.S. Armed Forces, 2000-2012



[a]Medical encounters: total hospitalizations and ambulatory visits with an ICD-9 code for pilonidal cyst in the primary diagnostic position (with no more than one encounter per individual per day).
[b]Individuals with at least one hospitalization or ambulatory visit for the condition.
[c]A measure of lost work time calculated in days due to bed days, convalescence, and one-half day for each ambulatory visit that resulted in limited duty.

members are affected by pilonidal disease. Among active component service members during the entire surveillance period, nearly 2 individuals per 1,000 were diagnosed each year with pilonidal cyst. It is of interest that the rate among male service members was only 13 percent higher than the rate among females and that diagnoses of recurrent pilonidal cyst affected a slightly higher percentage of females than males. During the 13-year period, the overall burden of pilonidal cyst disease increased in terms of numbers of medical encounters, hospital bed days, and lost work time, although the annual incidence rates beginning in 2007 remained below the overall incidence rate.

The observed increase in the burden of pilonidal cysts may reflect that, in many individuals, pilonidal cysts recur despite treatment. Clothier[5] reported that, in a cohort of military cases, a majority reported a history of weeks or months of symptoms such as inflammation and discharge culminating in one or more surgical procedures. Furthermore, individuals with a family history of pilonidal disease have been shown to have greater risk of recurrence after surgical repair.[2] Eleven percent of the active component cases identified in this analysis were diagnosed as recurrent cases more than one year after their initial diagnosis. This finding indicates that, in a subset of the affected population, pilonidal disease may require lengthy treatment and recovery time.

The quantity and characteristics of body hair are suspected etiologic factors for pilonidal cyst formation and infection. Differences in the amount and characteristics of hair may explain differences seen among the races/ethnicities reported here. Consistent with another study among military personnel,[6] white, non-Hispanics in this analysis had higher rates of pilonidal cyst than other race/ethnicities, but black, non-Hispanic service members had a slightly higher proportion of recurrent diagnoses. Fitzpatrick et al[6] have suggested that the higher recurrence rate among black, non-Hispanic individuals may be related to shaving of the natal cleft as part of pre- and post-operative care or preventative treatment. Pseudofolliculitis barbae, a chronic inflammatory skin condition related to shaving, is common among race/ethnicities with coarse, curly hair and may be associated with recurrent pilonidal disease. The use of other methods of hair removal – chemical depilatories, electrolysis, and laser hair removal – may decrease recurrence rates, particularly among individuals with coarse, curly hair.

In the active component, service members in armor/motor transport occupations had the highest rates of pilonidal cysts. Previous studies and military history have demonstrated that sedentary occupations, particularly in those such as driving where the sacral region is exposed to friction and bumping, have been associated with pilonidal disease.[7,10,11]

The annual incidence rates of inpatient and outpatient diagnoses of pilonidal cyst remained relatively stable during the 13-year period; however, the incidence rate during deployment nearly doubled. Some of the increase may be attributable to improvement in theater data capture from the start in 2005. The rate may also be higher and increasing due to conditions associated with deployment such as poor hygiene, stress, and long periods of travel in military vehicles on rough terrain.

Pilonidal disease is a problem in the U.S. military due to the number of lost duty days and recovery time for both acute and chronic cases. Service members with a history of pilonidal disease or with non-active pilonidal sinuses should be made aware of the importance of proper hygiene and preventive measures, particularly before and during a deployment.

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Puumala Hantavirus Outbreak Among U.S. Military Health Care Beneficiaries, Stuttgart, Germany – 2012

Zachary D. McCormic, MPH; Michele N. Balihe, MBT, MPH; Karyn A. Havas, DVM, PhD (MAJ, USA); Steven A. Baty, DVM, MPH (LTC, USA)

Hantaviruses are viruses of the family Bunyaviridae that are transmitted to humans via inhalation of the aerosolized excrement of rodents. The geographic distribution of hantavirus includes the Americas, Asia, and Europe. An outbreak of Puumala hantavirus infections among U.S. military health care beneficiaries was identified by the U.S. Army Public Health Command Region – Europe at U.S. Army installations in Stuttgart, Germany, during 2012. Overall, five cases (one probable and four confirmed) were identified in three service members, one U.S. civilian employee, and one dependent family member. Four cases were hospitalized, one of whom required dialysis. The outbreak investigation revealed that all cases exercised in forested areas and most were active smokers (4 out of 5). This report reviews the types of hantaviruses found worldwide and suggests that health care providers should suspect and consider possible hantavirus infections when evaluating patients with histories and clinical presentations consistent with such infections.

Hantaviruses are rodent-borne viruses of the family Bunyaviridae that have been identified as etiologic agents for hemorrhagic fever with renal syndrome (HFRS) and hantavirus pulmonary syndrome (HPS) in humans.[1] Each syndrome has varying degrees of severity depending on the specific hantavirus involved. Transmission to humans is through inhalation of aerosolized rodent excreta contaminated with the virus.[2] This enveloped RNA virus has been detected in the Americas, Asia, and Europe, including locations where U.S. service members are stationed.

The Americas are home to over 20 different types of hantaviruses **(Table 1)**.[2] The most commonly recognized is the Sin Nombre hantavirus, which is carried by the deer mouse and has been found as far north as the panhandle of Alaska and northern Canada, and as far south as Oaxaca, Mexico.[3,4,5] Precipitation and climate play a large role in the spread of hantavirus from rodent to human, particularly in the spring and summer months.[2] HPS is the predominant clinical presentation of human hantavirus infections occurring in the Americas.[6] In addition to a flu-like illness, individuals with HPS may experience distinctive symptoms based on the type of hantavirus contracted. The most common symptoms are fever, myalgia, and headache. For the Sin Nombre hantavirus, symptoms begin approximately 14 to 17 days after infection, and may last from 3 to 5 days.[2,5,6] Within 2 to 15 days, non-cardiac pulmonary edema and hypotension develop.[5] While renal impairment and hemorrhage are not typical manifestations of HPS, hemoconcentration, leukocytosis, and thrombocytopenia are observed.[1,5] The case fatality rate for HPS is approximately 50 percent.[1,5] From 1993 to 2012, a median of 28 HPS cases (range: 11-48) were reported annually in the United States.[7]

On the Korean peninsula, there are five types of hantavirus: Hantaan, Seoul, Amur, Soochong, and Muju **(Table 1)**.[2,5] Unlike in the Americas, HFRS is the most common human syndrome on the Korean peninsula. Hantaan hantavirus causes more severe disease than Seoul hantavirus.[8] After infection, clinical signs of HFRS develop within 7 to 36 days,[2,5,8] and the clinical course is marked by fever, hemorrhage, and renal failure.[1] Severe HFRS progresses through five phases: febrile, hypotensive, oliguric, diuretic, and convalescent.[1,5] Eleven to 40 percent of those with fever proceed to the hypotensive stage.[2,5] Oliguria is present in 40 to 60 percent of cases.[2,5] Nearly 50 percent of all hantavirus-related deaths occur as a result of the oliguric stage.[2] The diuretic stage may last for several weeks, while the convalescent stage can last for up to six months.[1,5] Over a three-year period, incidence of HFRS in Korea ranged from 2.1 to 6.6 per 100,000 person-months in civilian populations during the major epidemic period, and from 40 to 64 per 100,000 personnel over a four-year period in Korean military populations.[9] As such, in Korea, there are between 500 and 900 HFRS-related civilian hospitalizations annually.[10]

Finally, Europe is home to six different hantavirus species **(Table 1)**; the most commonly diagnosed species in human infections is the Puumala hantavirus. Puumala's natural host is the bank vole, and both the virus and the vole are found throughout Europe.[12] Hantavirus infections are prevalent during the spring and summer months.[2] HFRS is the most common clinical presentation of human hantavirus infection occurring in Europe and is associated with the Seoul, Dobrava, and Puumala hantaviruses. Disease severity ranges from subclinical to fatal. The Puumala virus causes the mildest form of HFRS (called nephropathia epidemica), is typically found in Scandinavia, and is most prevalent in Finland.[12] Puumala virus-associated mortality remains low, with estimated rates of 0.1 to 0.4 percent[1] or 0 to 0.2 percent [12] of cases. The Dobrava virus causes the most severe

TABLE 1. Most common hantaviruses and reservoirs by geographic area

Species of hantavirus	Reservoir
North America[2,5]	
Sin Nombre	*Peromyscus maniculatus* (Deer mouse)
Monongahela	*Peromyscus leucopus* (White-footed mouse)
New York	*Peromyscus leucopus* (White-footed mouse)
Black Creek Canal	*Sigmodon hispidus* (Cotton rat)
Bayou	*Oryzomys palustris* (Marsh rice rat)
Korea[2,5]	
Hantaan	*Apodemus agrarius* (Striped field mouse)
Seoul	*Rattus norvegicus* (Norway); *Rattus rattus* (black rats)
Amur	*Apodemus peninsulae* (Korean field mouse)
Soochong	*Apodemus peninsulae* (Korean field mouse)
Muju	*Myodes regulus* (Korean red-backed vole)
Europe[11]	
Puumala	*Myodes glareolus* (Bank vole)
Dobrava	*Apodemus flavicollis* (Yellow-necked mouse)
Saaremaa	*Apodemus agrarius* (Striped field mouse)
Seoul	*Rattus* spp. (Rats)
Tula	*Microtus* spp. (Voles)
Seewis	*Sorex araneus* (Common shrew)

form of disease in Europe, with associated mortality at 5 to 12 percent.[1,12]

Of the 23 European Union/European Economic Area countries that reported on hantavirus activity in 2010, 17 countries reported a total of 4,175 confirmed hantavirus infections; only six countries reported no cases. The top four reporting countries included Germany (48% of all cases), Finland (35%), Sweden (10%), and Belgium (5%).[13] In 2012, Germany reported 2,824 laboratory confirmed cases; the majority (60%) were residents of the German state of Baden-Württemberg, which includes the city of Stuttgart **(Figure 1)**.[14]

From 2003 to 2012, the U.S. Army identified eight confirmed hantavirus cases from the Americas, seven from the Korean peninsula, and 16 from Europe.[15] Between 2006 and 2011, seven cases were reported from the U.S. military population in the European Command area of responsibility (EUCOM AOR).[15] During 2012, however, the U.S. military bases in Stuttgart, Germany, experienced a sustained outbreak of hantavirus, with five Puumala virus cases diagnosed over a five month period, four of which occurred in the spring. These five cases were investigated to determine the extent of the outbreak, to assess the overall risk of infection among service members and other beneficiaries, and to educate the military population to prevent additional cases.

METHODS

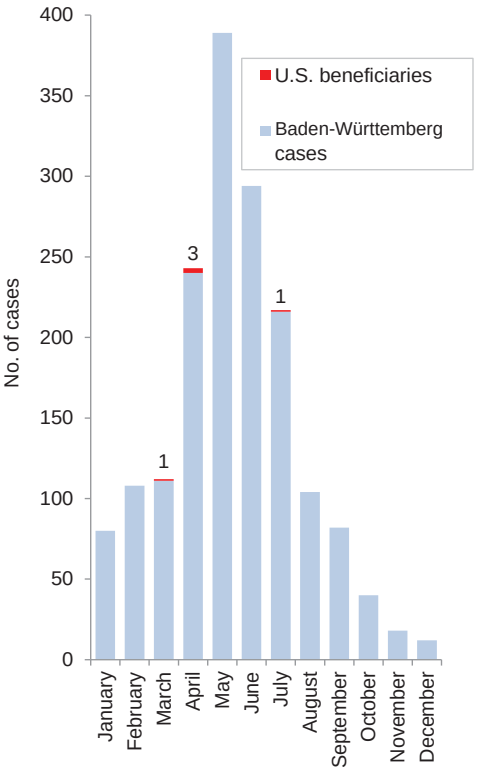
Medical records, including detailed medical history and physical examination notes and clinical laboratory tests were obtained for cases. A standardized medical record abstraction form was developed and completed for each case reported by the local health care clinic. In addition, a standardized questionnaire was administered by an interviewer and completed for each case to determine risk factors for contracting the disease.

A case (confirmed or probable) was defined as a U.S. military healthcare beneficiary residing in the EUCOM AOR with an illness clinically compatible with hantavirus infection and laboratory evidence suggestive of hantavirus infection in a blood sample collected in 2012. "Clinically compatible" was defined as a febrile illness with at least two of the following: myalgia, headache, muscle aches, gastrointestinal symptoms, lower back pain, hemorrhagic manifestations, or renal involvement. Following laboratory testing for hantavirus infection, cases were considered confirmed if their blood tested positive for both anti-hantavirus immunoglobulin IgM and IgG antibodies, while cases were deemed probable if their blood had the IgG antibodies only. Laboratory testing was performed by local civilian laboratories.

RESULTS

Four non-fatal, laboratory-confirmed cases and one probable case of Puumala hantavirus infection were reported. The dates of clinical onset for the majority of cases were in April (3 out of 5); there was one case in March and one in July **(Figure 1)**. The cases included three active duty

FIGURE 1. Cases of Puumala hantavirus infection among civilians in Baden-Württemberg,[a] Germany, and cases among U.S. military beneficiaries in Stuttgart, Germany, January-December 2012



[a]Baden-Württemberg is a German state that includes the city of Stuttgart.

TABLE 2. Characteristics and risk factors of the U.S. military beneficiary cases of Puumala hantavirus infection (n=5)

Characteristic	No.
Sex	
Female	1
Male	4
Age group	
<20	1
20-39	2
40-59	2
Symptoms	
Fever	5
Muscle aches	5
Abdominal/back pain	3
Nausea	3
Dyspnea	3
Risk factors	
Running/walking in the forest	5
Construction at the work site	4
Smoking[a]	4
Living close to the forest[b]	1
Cleaning shed	1
Hole in office building	1

[a]Any smoking
[b]Living 100 meters or less from forested areas

service members (one each from the Army, Air Force, and Marine Corps), one Department of Defense (DOD) civilian employee, and one military family member who was employed on the military base. All of these patients worked and resided in Stuttgart: three at Patch Barracks, one at Kelley Barracks, and one at Panzer Kaserne. The three military bases are located within 20 kilometers of each other. A majority of cases were male (4 out of 5); the average age of the cases was 32 years (range 18–49) **(Table 2)**. All patients reported fever and muscle aches. Significant laboratory findings included elevated serum creatinine concentrations (all 5 cases; range: 1.8-14.6 mg/dL) and thrombocytopenia (1 case). Four of the patients were hospitalized; the median duration of hospitalization was four days (range 3-15 days). One of the hospitalized cases required dialysis. All five cases reported either running or walking outdoors in forested areas, and four of the five reported smoking **(Table 2)**.

EDITORIAL COMMENT

Hantavirus infections have been a significant disease among military populations dating back to the Korean War, during which over 3,000 United Nations and U.S. troops developed Korean hemorrhagic fever.[2] Other notable outbreaks have previously been identified in U.S. soldiers stationed in Korea,[16] but this is the first hantavirus illness outbreak identified among U.S. service members stationed in the EUCOM AOR.

The fever and muscle aches reported in all five cases followed the classic Puumala course of infection. Nausea, dyspnea, and severe abdominal and back pain were observed in three of the five cases. Similar findings have been observed with both nausea and severe abdominal and back pain in other European outbreaks,[17,18,19] but the patients described here experienced a higher frequency of dyspnea than has been reported in other outbreaks. The smoking habits of these patients may have predisposed them to developing dyspnea. Smoking has been identified previously as a risk factor for developing hantavirus illness.[20]

Patients were hospitalized for a median of four days (range: 3-15), slightly shorter than the median of seven to nine days reported in previous studies.[17,18,19] Severity of disease, decreased time between exposure and treatment, and overall general physical health status may have had an effect on the overall number of days hospitalized.

Walking or running in forested areas was the most common risk factor identified within this cohort. Many of these forested areas are home to small rodents, where hantaviruses may be present.[1] In endemic areas, outdoor physical activity is a known risk factor for hantavirus infections.[19]

Multiple factors may have contributed to the outbreak of hantavirus during 2012. The fall of 2011 was a mast year for beech and other deciduous trees in the area.[21] During a mast year, trees produce a high volume of seeds that are consumed by many rodent species, including the bank vole, that carry the Puumala strain of hantavirus.[22] The high volume of readily-available food may have led to decreased competition for resources, resulting in an increase in the local rodent population. The increased rodent population could have created more opportunities for interactions among rodents and thus virus transmission, increasing the proportion of infected rodents.[23] Large numbers of rodents have been found as a potential risk factor for human hantavirus infection,[2,5] especially in areas like Baden-Württemberg, where hantavirus infections are common. Trapping and testing of rodents for hantavirus were not performed for this study, but recent increases in bank vole populations have been previously documented in the Baden-Württemberg area.[21]

In addition, the mild fall of 2011 may have led to increased rodent activity. The fall of 2011 was 5.1°C above the average temperature.[24] The higher temperatures may have allowed rodents additional time to collect food, reproduce, and find shelter for the winter. Interestingly, the winter was 0.5°C below the average temperature, with much of the cooling occurring in February 2012. Lower winter temperatures have also been associated with higher hantavirus prevalence among bank voles.[25] Therefore, humans who reengaged in outdoor activity after the winter had an increased likelihood of contact with the excreta of hantavirus-infected rodents.

Two challenges were noted during the course of this investigation. First, four of the cases sought medical attention from the local economy, as opposed to the on-post medical treatment facilities. As a result, there were delays in obtaining accurate and timely information on four of the ill patients within the cohort. Second, testing for IgM antibody titer was not performed in one case. Although this individual had a positive IgG antibody titer and a clinical syndrome compatible with hantavirus infection, confirmation of acute hantavirus infection could not be made. The presenting illness could have been due to another cause and the positive

IgG antibody titer might have represented either a false positive test result or persistent antibody from a previous hantavirus illness.

Due to frequent deployment and travel among U.S. military service members, it is important that health care providers document travel history whenever possible. Hantavirus infections are present in three different locations where U.S. service members may be stationed: the western United States, Korea, and Europe. Providers should consider hantavirus infection when a patient presents with fever and muscle aches and either currently resides in, or has recently traveled to, an area endemic for hantavirus, particularly during seasons of higher infectivity. Depending on the country of travel, the source, course, and treatment of disease may differ. As a disease of significant force protection and public health concern, early diagnosis and treatment are crucial.

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Incidence and Prevalence of Select Cardiovascular Risk Factors and Conditions, Active Component, U.S. Armed Forces, 2003-2012

This report provides estimates of the incidence of select risk factors for cardiovascular disease among members of the active component of the Armed Forces. The definitions of incident cases of each risk factor were based upon the documentation of relevant diagnostic codes in the electronic health records of service members. Numbers of service members with diagnoses of each of the factors were: hyperlipidemia (n=300,340), obesity (n=235,407), hypertension (n=230,564), abnormal blood glucose level (n=47,009), and diabetes (n=13,901). Incidence rates of all the risk factors of interest increased with advancing age. Rates of diagnoses of hypertension and obesity were higher among black, non-Hispanic service members than among other racial/ethnic groups. Asian/Pacific Islanders had the highest rates of hyperlipidemia, abnormal blood glucose level, and diabetes. Male service members had higher rates of hypertension, hyperlipidemia, and diabetes, but females had higher rates of obesity and abnormal blood glucose level. Of all active component service members included in this analysis (n=3,297,786), 18.5 percent (n=611,185) were diagnosed with at least one of the risk factors during the ten-year surveillance period.

Cardiovascular disease (CVD) comprises disorders of the heart and circulatory system including, most notably, coronary heart disease (CHD) (e.g., myocardial infarction, angina pectoris) and cerebrovascular disease. While several risk factors for the development of CVD cannot be altered (e.g., increasing age, family history of CVD), others are susceptible to modification through lifestyle change or medical interventions to prevent or delay the occurrence of acute CVD events (e.g., heart attack or stroke).[1]

Recently, the American Heart Association (AHA) developed a metric for cardiovascular health which includes seven separate components; four are related to health behaviors (e.g., not smoking, maintaining healthy diet and physical activity patterns, and being normal body weight) while three are related to measurable medical parameters of health (e.g., total serum cholesterol level, blood pressure, and fasting blood glucose). These seven components together can be used to categorize individuals into ideal, intermediate, and poor levels of health status and can be used as a public health metric to track the cardiovascular health of a population over time.[1]

Although members of the U.S. military are generally fitter and healthier than the general U.S. population, significant numbers of military members report health behaviors that would adversely impact their cardiovascular risk profile. For example, estimates of smoking prevalence in U.S. military members are generally higher than estimates for U.S. civilians. In the 2011 Department of Defense Health Related Behaviors Survey of Active Duty Military Personnel, about one-quarter (24.5%) of respondents to the survey reported using cigarettes in the past month as compared to estimates that approximately 20.6 percent of civilians have used cigarettes in the past month. In addition, about 15 percent of military respondents said they had been diagnosed with high blood pressure by a doctor and 13 percent had been diagnosed with high cholesterol in their lifetime.[2]

This report provides estimates of counts, rates, and trends of measures of the AHA cardiovascular metrics: estimates of incidence for hypertension, hyperlipidemia, obesity, abnormal blood glucose level, and diabetes.

METHODS

The surveillance period was 1 January 2003 to 31 December 2012. The surveillance population included any individual who served in the active component of the U.S. Armed Forces at any time during the surveillance period. All data used to determine incident cases were derived from records routinely maintained in the Defense Medical Surveillance System (DMSS).

For surveillance purposes, an incident case of hypertension, hyperlipidemia, obesity, or abnormal blood glucose was defined as any inpatient or outpatient medical encounter with one of the ICD-9-CM codes of interest in any diagnostic position. The following ICD-9-CM codes were used to define cases. For hypertension, the ICD-9-CM codes of interest were 401.x (i.e., essential hypertension). For hyperlipidemia, the ICD-9-CM codes of interest included 272.0-272.4 (i.e., pure hypercholesterolemia, pure hyperglyceridemia, mixed hyperlipidemia, hyperchylomicronemia, and other and unspecified hyperlipidemia). For obesity, the ICD-9-CM codes of interest were 278.00, 278.01, V85.3x, V85.4x, and V85.54 (i.e., obesity, unspecified, morbid obesity, Body Mass Index between 30-39, adult, Body Mass Index 40 and over, adult, and Body Mass Index, pediatric, greater than or equal to 95th percentile for age). For abnormal blood glucose level, the ICD-9-CM codes of interest were 790.21, 790.22, and 790.29 (i.e., impaired fasting glucose, impaired glucose tolerance test, and other abnormal glucose).

An incident case of diabetes was defined as a single inpatient encounter with ICD-9-CM code 250.xx in the primary diagnostic position or two or more outpatient encounters with a defining code not more than 92 days apart.

An individual could be counted as an incident case only once during the surveillance period; prevalent cases (i.e., cases that had received one of the diagnoses of interest before the start of the surveillance period) were removed from the analysis.

Counts and percentages of service members who had an incident diagnosis of one or more CVD risk factors during the surveillance period were assessed. For this analysis of multiple risk factors, incident diagnoses of abnormal blood glucose level and diabetes were combined into a single metric to represent impaired glucose metabolism. All service members serving at any point during the period in the active component of any service were included in the analysis in the denominator. Individuals receiving an incident diagnosis of any of four CVD risk factors (i.e., hypertension, hyperlipidemia, obesity, or impaired glucose metabolism) were included in the numerator. Individuals were categorized on the basis of how many incident CVD risk factor diagnoses they received during the surveillance period (i.e., 1,2,3, or 4).

RESULTS

Hypertension

During the surveillance period, there were 230,564 incident diagnoses of essential hypertension in active component service members. The overall incidence rate for the period was 16.1 per 1,000 person-years (p-yrs) **(Table 1)**. Incidence rates of hypertension remained relatively stable during the period; rates were highest in 2005 (17.4 per 1,000 p-yrs) and have been lower during the last four years of the surveillance period as compared to the first four years of the period **(Figure 1)**.

As expected, incidence rates increased with advancing age and the highest rates were found in those aged 40 years or greater **(Figure 2)**. Incidence rates by age group remained relatively stable during the surveillance period.

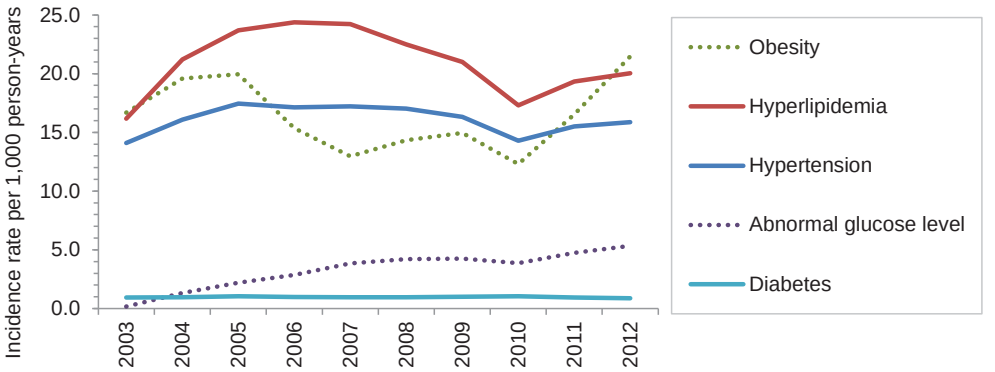
Eight times as many males as females were diagnosed with hypertension during the period, and the incidence rate in males was 36 percent higher than in females overall (16.7 cases per 1,000 p-yrs vs. 12.3 cases per 1,000 p-yrs) **(Table 1)**. Annual incidence rates of hypertension among females have declined steadily from a high of 14.4 cases per 1,000 p-yrs in 2005 to 10.7 per 1,000 p-yrs in 2012. No striking trend for males has been evident during the period.

Black, non-Hispanic service members had higher incidence rates of hypertension compared to service members of other race/ethnicities **(Table 1, Figure 3)**. This pattern was true across all age groups. While incidence in black, non-Hispanics decreased during the period in individuals

TABLE 1. Incidence counts and incidence rates (per 1,000 person-years) of cardiovascular risk factors, active component, U.S. Armed Forces, 2003-2012

	Hypertension		Hyperlipidemia		Obesity		Abnormal glucose level		Diabetes	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Total	230,564	16.1	300,340	20.9	235,407	16.4	47,009	3.3	13,901	1.0
Age										
<21	8,243	4.5	5,204	2.8	21,504	11.6	1,254	0.7	328	0.2
21-24	33,970	8.8	28,106	7.3	63,282	16.4	4,144	1.1	1,014	0.3
25-29	43,686	13.4	52,433	16.0	55,627	17.0	6,164	1.9	1,450	0.4
30-34	37,343	17.8	54,051	25.8	33,284	15.9	6,285	3.0	1,732	0.8
35-39	45,972	26.6	68,329	39.5	31,536	18.2	9,650	5.6	3,188	1.8
40+	61,350	40.2	92,217	60.4	30,174	19.8	19,512	12.8	6,189	4.1
Sex										
Female	25,480	12.3	29,176	14.1	47,165	22.7	7,932	3.8	1,584	0.8
Male	205,084	16.7	271,164	22.1	188,242	15.4	39,077	3.2	12,317	1.0
Rank										
Junior enlisted	63,049	10.1	54,353	8.7	114,954	18.4	8,395	1.3	2,363	0.4
Senior enlisted	126,851	22.2	176,510	30.8	98,403	17.2	28,094	4.9	9,500	1.7
Junior officer	17,997	12.5	28,654	19.8	12,075	8.4	3,264	2.3	708	0.5
Senior officer	22,667	24.6	40,823	44.3	9,975	10.8	7,256	7.9	1,330	1.4
Race/ethnicity										
White, non-Hispanic	132,245	14.7	185,861	20.6	136,908	15.2	25,377	2.8	6,087	0.7
Black, non-Hispanic	58,157	24.4	53,092	22.2	50,099	21.0	10,637	4.5	4,387	1.8
Hispanic	18,710	12.3	30,516	20.1	29,198	19.2	4,961	3.3	1,467	1.0
Asian/Pacific Islander	9,649	16.9	14,728	25.8	7,310	12.8	3,319	5.8	1,166	2.0
American Indian/Alaskan Native	1,045	6.0	1,286	7.4	1,258	7.2	233	1.3	59	0.3
Other	10,758	15.8	14,857	21.8	10,634	15.6	2,482	3.6	735	1.1
Service										
Army	99,299	19.0	118,315	22.7	123,925	23.7	17,905	3.4	5,392	1.0
Navy	51,339	15.1	75,872	22.3	41,046	12.1	14,453	4.2	4,510	1.3
Air Force	56,014	16.4	75,650	22.1	55,162	16.1	10,334	3.0	2,952	0.9
Marine Corps	16,319	8.6	18,310	9.7	9,806	5.2	2,103	1.1	590	0.3
Coast Guard	7,593	18.7	12,193	30.0	5,468	13.5	2,214	5.4	457	1.1

FIGURE 1. Annual incidence rates of cardiovascular risk factors and conditions, active component, U.S. Armed Forces, 2003-2012



35 or over, incidence rates in those under 35 were higher in 2012 than at the beginning of the period **(data not shown)**.

Hyperlipidemia

A total of 300,340 service members received incident diagnoses of hyperlipidemia during the 10-year surveillance period; about 90 percent of these diagnoses (n=271,164) occurred among male service members **(Table 1)**.

As with hypertension, the strongest demographic correlate of increasing incidence of hyperlipidemia was increasing age **(Table 1)**. More than half of incident diagnoses (53%) were given to service members aged 35 and older and the incidence rate in those 40 and older was 50 percent greater than the rate in those 35 to 39 years of age (60.4 cases per 1,000 p-yrs. vs. 39.5 cases per 1,000 p-yrs) **(Figure 4)**.

Incidence rates of hyperlipidemia were similar among all race/ethnicity groups with the exception of American Indian/Alaskan Native service members who had much lower incidence rates of hyperlipidemia between 2003 and 2012 than service members of other race/ethnicities. However, this group demonstrated the greatest increase in annual rates from the beginning to the end of the surveillance period (2003: 2.9 per 1,000 p-yrs; 2012: 19.9 per 1,000 p-yrs) **(data not shown)**.

Obesity

Overall incidence rates of obesity were highest in the final year of the surveillance period (2012: 21.5 cases per 1,000 p-yrs), although incidence rates fluctuated over the 10-year period and no steady increasing trend was seen **(Figure 1)**.

Although approximately 80 percent of incident obesity diagnoses were in male service members (n=188,242), female service members had higher overall incidence rates of obesity (22.7 cases per 1,000 p-yrs vs. 15.4 cases per 1,000 p-yrs) **(Table 1)**. Black, non-Hispanic and Hispanic service members had higher incidence rates of obesity than other race/ethnicities.

Abnormal glucose levels

Relative to hypertension and hyperlipidemia, fewer service members received incident diagnoses of abnormal glucose level during the surveillance period (n=47,009) **(Table 1)**. However, annual incidence rates of diagnoses of abnormal glucose level increased dramatically over the course of the 10-year period (2003: 0.17 cases per 1,000 p-yrs; 2012: 5.3 per 1,000 p-yrs) **(Figure 1)**.

Males and females had similar overall rates of incident diagnoses of abnormal glucose level and both genders demonstrated increasing annual rates over the surveillance period **(data not shown)**.

Asian/Pacific Islander and black, non-Hispanic service members had higher overall rates of incident abnormal glucose level diagnoses as compared to their counterparts **(Table 1)**.

FIGURE 2. Annual incidence rates of hypertension by age group, active component, U.S. Armed Forces, 2003-2012

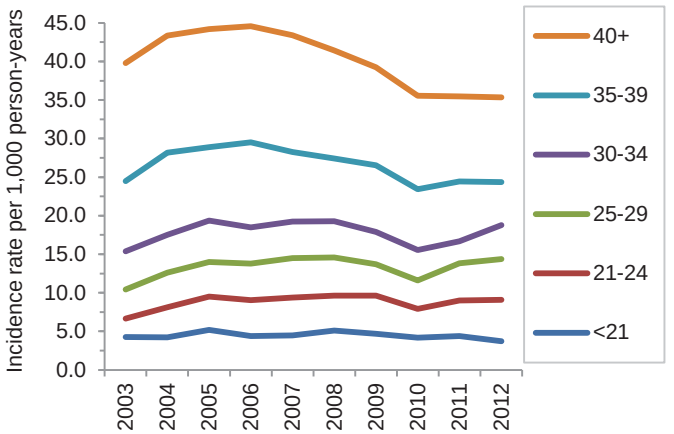


FIGURE 3. Annual incidence rates of hypertension by racial/ethnic group, active component, U.S. Armed Forces, 2003-2012

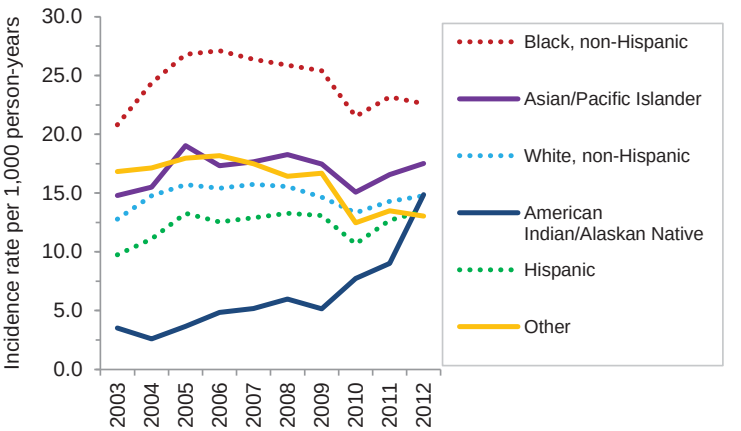


FIGURE 4. Annual incidence rates of hyperlipidemia by age group, active component, U.S. Armed Forces, 2003-2012

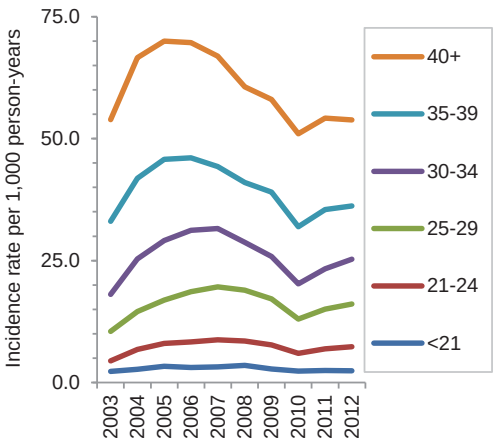


TABLE 2. Percentage of service members with one or more cardiovascular disease risk factors,[a] active component, U.S. Armed Forces, 2003-2012

	No.	%
Number with 1 incident diagnosis	443,820	13.5
Number with 2 incident diagnoses	129,125	3.9
Number with 3 incident diagnoses	32,975	1.0
Number with 4 incident diagnoses	5,265	0.2

[a]Hypertension, hyperlipidemia, obesity, or glucose/diabetes

Diabetes

Incident diagnoses of diabetes impacted the fewest service members of the five risk factors examined; 13,901 service members received an incident diagnosis of diabetes during the 10-year period and incidence rates of diabetes remained relatively stable during the 10-year period **(Table 1, Figure 1)**.

Service members aged 40 years and older were more than twice as likely to receive incident diabetes diagnoses as compared to those between 35 and 39 years of age **(Table 1)**.

Multiple risk factors

A total of 3,297,786 service members were included in the analysis. Of these service members, 443,820 (13.5%) received just one incident diagnosis of a CVD risk factor; 3.9 percent (n=129,125) received two diagnoses; one percent (n=32,975) received three diagnoses; and 0.2 percent (n=5,265) received four diagnoses over the course of the entire surveillance period **(Table 2)**.

EDITORIAL COMMENT

This report documents that approximately 18.5 percent (n=611,185) of those who served in the active component force during the surveillance period received an incident diagnosis of at least one of the CVD risk factors examined in this report.

Over 230,000 service members received an incident diagnosis of hypertension in the last ten years and black, non-Hispanic service members were disproportionately affected. This finding parallels findings in the general U.S. population; it has been well established that black, non-Hispanics in the U.S. general population have higher prevalence rates of hypertension than any other group and that, compared to white, non-Hispanics, they develop hypertension earlier in life.[1,3]

Hatzfeld et al. examined several of the same conditions reported on in this analysis (e.g., hypertension, hyperlipidemia, diabetes) in U.S. Air Force members.[4] Although case definitions for conditions in that study were more specific (e.g., requiring two or more diagnoses for hypertension and hyperlipidemia), there were a number of findings similar to those in this report. For example, Hatzfeld and colleagues also reported that black, non-Hispanics had a higher prevalence of hypertension in every age category as compared to white, non-Hispanic airmen. The authors noted that many of the hypothesized factors for this disparity (e.g., social and economic factors and access to health care) are potentially less pronounced in a "prescreened USAF population with equitable heath care and living conditions." Ongoing research to examine the factors that may influence this continued disparity is warranted.

Because service members undergo frequent and routine periodic health assessments, there are multiple opportunities to assess, diagnose and treat CVD risk factors during the course of their service. In fact, the increasing incidence rates of several conditions (e.g., hypertension) among younger service members may reflect increased awareness and earlier diagnosis.

While the more severe sequelae of these risk factors for CVD conditions may not become manifest while service members are actively serving, increased surveillance and control of these risk factors have the potential to favorably impact service members' long term health, thereby improving their quality of life and potentially reducing future medical costs for the care of chronic health conditions.

These estimates of incidence for CVD risk factors should be interpreted with consideration of several limitations. Incident cases were ascertained from ICD-9-CM diagnosis codes recorded in administrative medical records; several of the case definitions required documentation of an ICD-9-CM during only one medical encounter in any diagnostic position. As a result, some of the incident cases ascertained may represent miscoded, erroneously coded, or "rule out" diagnoses.

In addition, although very sensitive case definitions were used for the CVD risk factors examined in this analysis, the estimates of incidence and prevalence of those factors in this report are likely lower than the "true" incidence and prevalence in the U.S. military population , although the degree of underestimation probably differs by condition.

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Brief Report

Deaths Attributed to Underlying Cardiovascular Diseases, Active and Reserve Components, U.S. Armed Forces, 1998-2012

Cardiovascular disease (CVD) encompasses a wide range of conditions which affect the heart and circulatory system including coronary heart diseases, cerebrovascular disease, peripheral artery disease, deep vein thrombosis and pulmonary embolism, and congenital heart disease. CVD is the leading cause of death worldwide and in the United States. Although CVD death rates in the United States declined by 31 percent between 2000 and 2010, CVD remains the underlying cause of approximately one in three American deaths. Coronary heart disease (e.g., myocardial infarction) and cerebrovascular disease are the first and fourth leading causes of death in the United States, respectively.[1,2]

The *MSMR* has previously reported on number, rates, and causes of death among members of the U.S. Armed Forces; between 2000 and 2011, approximately seven percent of deaths were related to CVD.[3] This report expands upon previous summaries by providing a more detailed analysis of numbers, rates, and trends of deaths related to CVD during a 15-year period.

METHODS

The surveillance period was 1 January 1998 to 31 December 2012. The surveillance population included all individuals who served on active duty during the surveillance period as a member of the active or reserve component of the U.S. Army, Navy, Air Force, or Marine Corps. Deaths related to CVD of active duty service members were ascertained from records provided by the Armed Forces Medical Examiner System (AFMES) and routinely provided to the Armed Forces Health Surveillance Center for integration into the Defense Medical Surveillance System (DMSS). AFMES classifies deaths through the use of an "underlying cause of death" code; for this analysis, a CVD-related death was defined by a casualty record with one of the underlying cause of death codes included in Table 1. Deaths in members of the Coast Guard are not captured in the AFMES and thus are not included in this analysis.

TABLE 1. Underlying causes of death attributed to cardiovascular disease

Atherosclerotic cardiovascular disease so described
Conduction disorders/cardiac dysrhythmias
Cardiomyopathy
All other forms of chronic ischemic heart disease
Acute myocardial infarction
Subarachnoid hemorrhage
Hypertensive heart disease
Aortic aneurysm and dissection
All other and ill-defined forms of heart disease
Intracerebral and other intracranial hemorrhage
Pulmonary embolism
Phlebitis, thrombophlebitis, venous embolism, and thrombosis
Diseases of pericardium/acute myocarditis
Cerebral infarction
Myocarditis unspecified/myocardial degeneration
Nonrheumatic mitral valve disorders
Stroke not specified as hemorrhage or infarction
Nonrheumatic aortic valve disorders
Other and unspecified heart failure
Other diseases of arteries arterioles and capillaries
Other disorders of circulatory system
Congestive heart failure
Hypertensive renal disease
Other acute ischemic heart diseases
Cerebrovascular diseases

RESULTS

Between 1998 and 2012, there were a total of 1,639 deaths in service members on active duty whose underlying cause of death was attributed to cardiovascular disease. Of these deaths, 516 occurred in members of the reserve component (who died while on active duty) and 1,123 deaths occurred in active component members. Death rates in active component members declined over the 15-year period from 7.0 per 100,000 person-years (p-yrs) in 1998 to 5.1 per 100,000 p-yrs in 2012; the lowest cardiovascular death rate was in 2010 (4.1 per 100,000 p-yrs) **(Figure 1)**.

Among active component service members, demographic correlates of a CVD cause of death were similar to those reported in the literature. The strongest demographic correlate of increased risk of CVD death was older age. For example, CVD death rate was highest in those aged 40 years or older (20.4 per 100,000 p-yrs)–three times as high as those aged 30-39 years. The CVD death rate in males was more than twice that in females (5.9 per 100,000 p-yrs vs. 2.6 per 100,000 p-yrs). Black, non-Hispanic active component service members had almost twice the rate of CVD-related deaths as their white, non-Hispanic counterparts (9.1 vs. 4.9 per 100,000 p-yrs) **(Table 2)**.

By far, the leading specific cause of CVD death was atherosclerotic cardiovascular disease; approximately 38 percent of active component deaths (n=423) and 45 percent of deaths in reserve component members (n=232) were attributed to atherosclerotic cardiovascular disease **(data not shown)**. The second and third most frequent specific underlying causes of death in active component members were conduction disorders and cardiac dysrhythmias (n=117) and cardiomyopathy

FIGURE 1. Annual numbers and rates of deaths attributed to underlying cardiovascular disease, active component, U.S. Armed Forces, 1998-2012

TABLE 2. Demographic and military characteristics of individuals whose deaths were attributed to underlying cardiovascular disease, active component, U.S. Armed Forces, 1998-2012

	No.	Rate[a]
Total	1,123	5.4
Service		
Army	446	5.9
Navy	348	6.6
Air Force	244	4.7
Marine Corps	85	3.1
Sex		
Male	1,045	5.9
Female	78	2.6
Race/ethnicity		
White, non-Hispanic	632	4.9
Black, non-Hispanic	336	9.1
Other/unknown	155	3.8
Age		
<20	25	1.6
20-24	139	2.0
25-29	132	2.9
30-39	392	6.8
40+	435	20.4
Military occupation		
Combat-specific	195	4.5
Health care	100	5.8
Admin/supply	347	7.1
Other	481	4.9

[a]Death rate per 100,000 person-years of service.

(n=100); in reserve component members, the second and third most frequent specific underlying causes of death were acute myocardial infarction (n=52) and conduction disorders and dysrhythmias (n=28) **(data not shown)**.

EDITORIAL COMMENT

This analysis demonstrated that rates of CVD mortality have declined during the past 15 years in active component service members; this finding parallels similar findings among U.S. civilians.

Although the majority of CVD deaths in U.S. service members were attributed to atherosclerotic disease, there is evidence to suggest that the prevalence of atherosclerotic disease has declined in deployed service members compared to their counterparts in earlier conflicts.[4]

The finding that black, non-Hispanic service members have higher CVD death rates than other racial and ethnic groups mirrors similar findings in the U.S. civilian population.[2] The higher rate of hypertension (i.e., high blood pressure) in black, non-Hispanics likely contributes to the disproportionate rate of CVD mortality among this group. Black, non-Hispanic U.S. civilians experience the highest prevalence of hypertension in the world, and the prevalence in this population continues to increase.[2] Similarly, Hatzfeld et al. demonstrated that the prevalence of hypertension is highest in non-Hispanic blacks (12.4%) in a study conducted among members of the U.S. Air Force.[5] As reported elsewhere in this issue of the *MSMR*, incidence rates of hypertension in black, non-Hispanic service members are also higher than rates of hypertension in any other racial/ethnic group.[6]

Yang et al. have demonstrated that hypertension is associated with the largest adjusted population attributable fraction (PAF) for CVD mortality at 40.6 percent (95% confidence interval: 24.5%-54.6%).[7] The PAF quantifies the reduction in average CVD mortality that could occur if exposure to a risk factor (e.g., hypertension) was eliminated; for example, a PAF of 40 percent means that, theoretically, 40 percent of CVD mortality deaths could be eliminated if hypertension were eliminated. Consideration of targeted interventions to reduce the rates of CVD risk factors in all service members and among at-risk sub groups is warranted.[7]

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2. Go AS, Mozaffarian D, Roger VL, et al. American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics-2013 update: a report from the American Heart Association. *Circulation*. 2013 Jan 1;127(1):e6-e245.
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5. Hatzfeld JJ, LaVeist TA, Gaston-Johansson FG. Racial/ethnic disparities in the prevalence of selected chronic diseases among US Air Force members, 2008. *Prev Chronic Dis.* 2012; 9:1101-1136.
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Brief Report

Hospitalizations for Acute Myocardial Infarction, Active Component, U.S. Armed Forces, 2004-2012

This retrospective, population-based analysis was designed to assess temporal patterns of hospitalizations for acute myocardial infarction (AMI) in active component service members in the years 2004 through 2012. Hospitalizations with an ICD-9-CM code indicating acute myocardial infarction (ICD-9-CM: 410.x0 or 410.x1) in the first or second diagnostic position were ascertained and aggregated by month and year of admission.

Multiple studies have demonstrated that the incidence of, and mortality from, AMI varies seasonally with peak incidence occurring during the winter months. There are several proposed mechanisms for this observed phenomenon including the hemodynamic effects of cold weather (e.g., increases in body metabolism, subsequent systemic vascular resistance, and arterial blood pressure), the impact of respiratory tract infections (e.g., seasonal influenza) on acute cardiovascular events, and seasonal changes in activity, diet, weight, and stress levels.[1-4]

This analysis did not demonstrate a seasonal periodicity or pattern with regard to the 1,741 hospitalizations for AMI in active component service members during the surveillance period **(Figure 1)**. One reason for this may be the underlying age distribution of the active component military as compared to the general population; seasonal periodicity in cardiovascular events has been observed to be less pronounced in younger individuals (e.g., those less than 65 years of age).[5]

This analysis did demonstrate a slight decline in the annual numbers and rates of hospitalizations for AMI among active component service members during the period. The rate of AMI hospitalization fell from 15.1 per 100,000 person-years (p-yrs) in 2004 to 11.8 per 100,000 p-yrs in 2012 **(Figure 2)**. Concomitantly, the mean monthly average by year for AMI dropped from 18.3 AMI hospitalizations per month in 2004 to 14.1 AMI hospitalizations per month in 2012 (the lowest monthly average during the surveillance period) **(data not shown)**.

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5. Reavey M, Saner H, Paccaud F, Marques-Vidal P. Exploring the periodicity of cardiovascular events in Switzerland: Variation in deaths and hospitalizations across seasons, day of the week and hour of the day. *Int J of Card*. 2013;168(3):2195-2200.

FIGURE 1. Monthly incidence rates of acute myocardial infarction hospitalizations, active component, U.S. Armed Forces, 2004-2012

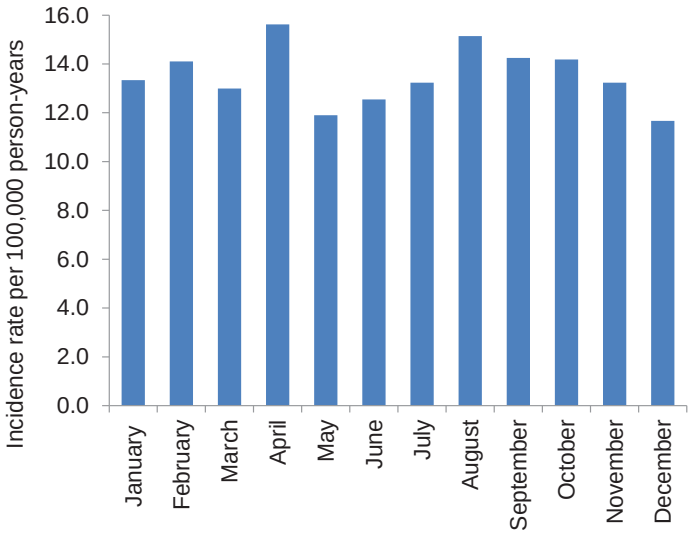
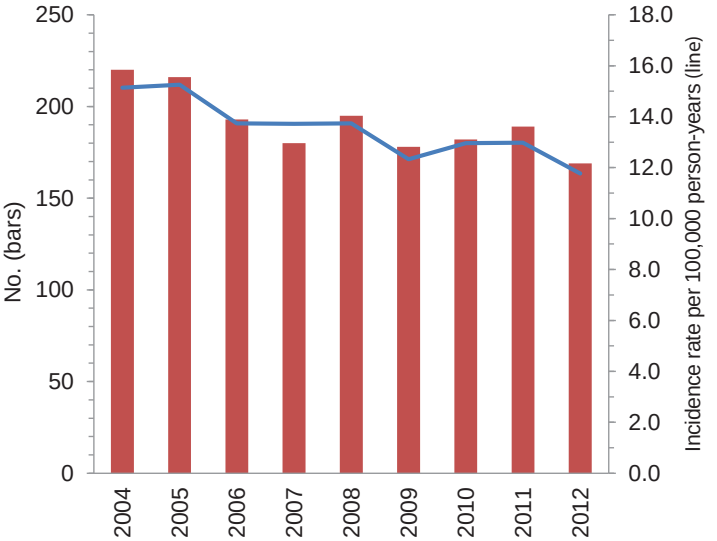


FIGURE 2. Annual incidence counts and incidence rates of acute myocardial infarction hospitalizations, active component, U.S. Armed Forces, 2004-2012



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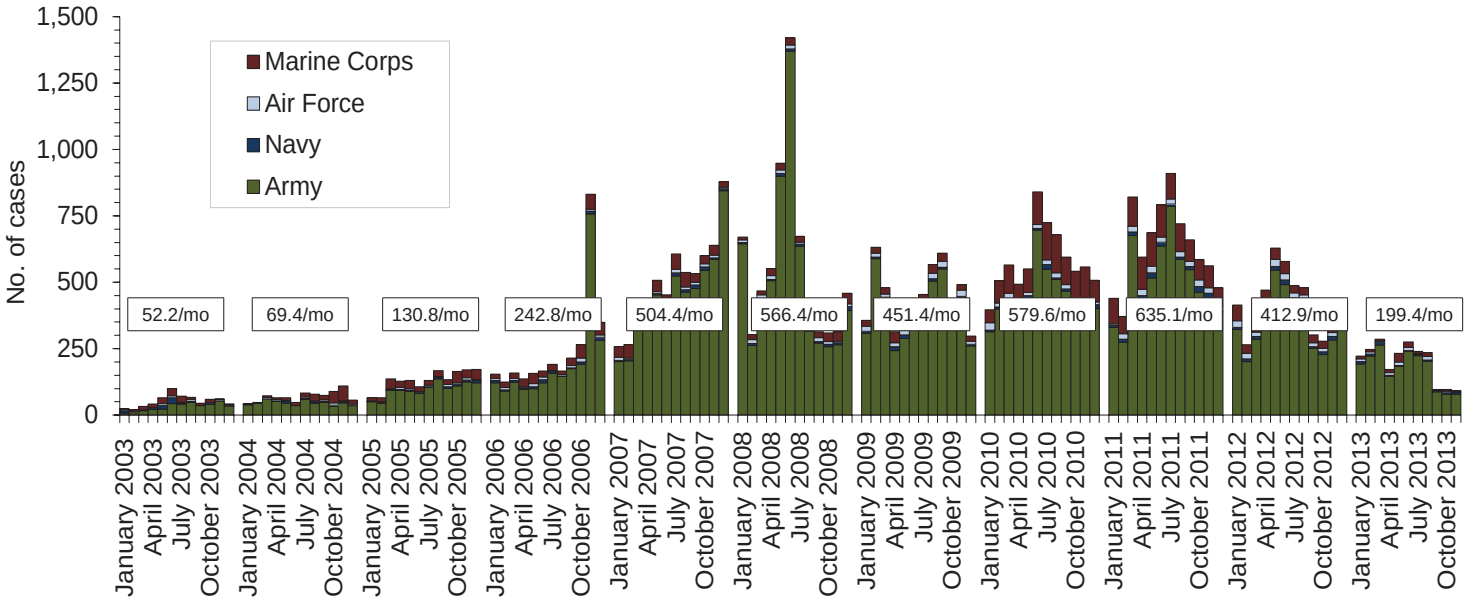
Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003-November 2013 (data as of 19 December 2013)

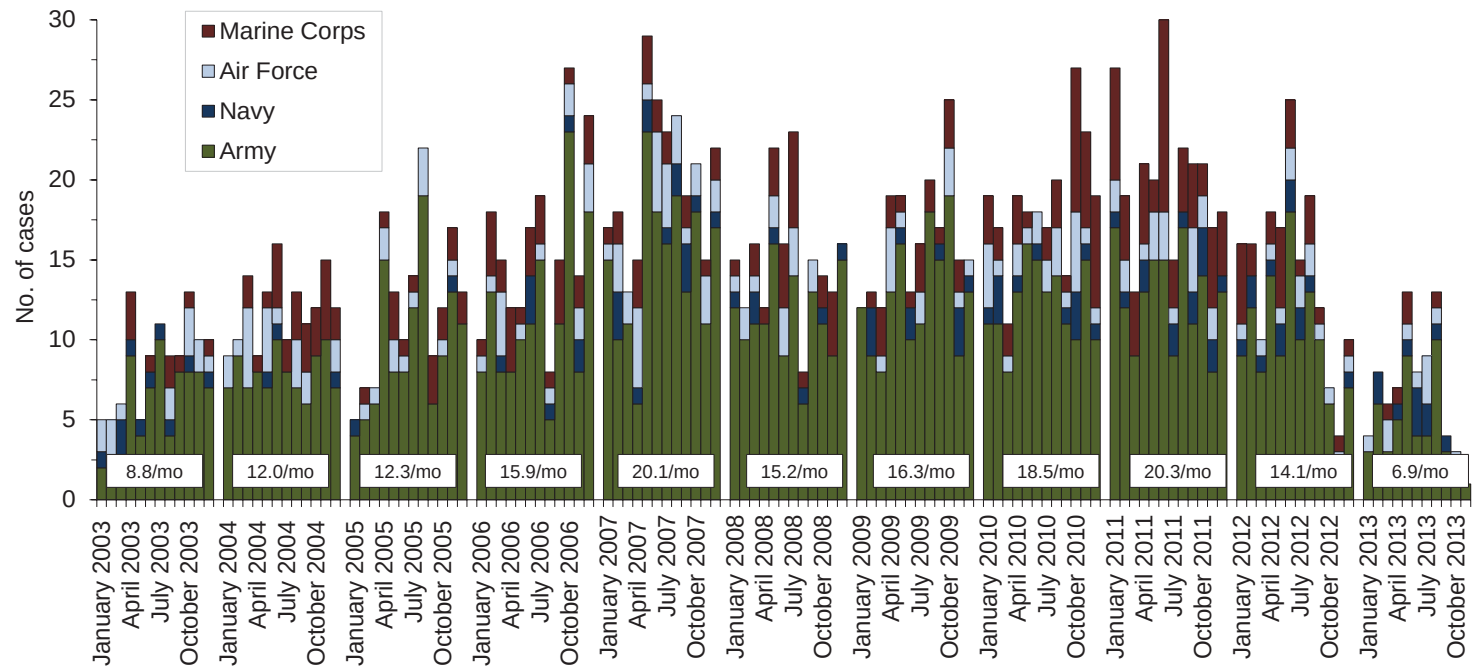
Traumatic brain injury (ICD-9: 310.2, 800-801, 803-804, 850-854, 907.0, 950.1-950.3, 959.01, V15.5_1-9, V15.5_A-F, V15.52_0-9, V15.52_A-F, V15.59_1-9, V15.59_A-F)[a]



Reference: Armed Forces Health Surveillance Center. Deriving case counts from medical encounter data: considerations when interpreting health surveillance reports. *MSMR*. Dec 2009; 16(12):2-8.

[a]Indicator diagnosis (one per individual) during a hospitalization or ambulatory visit while deployed to/within 30 days of returning from OEF/OIF. (Includes in-theater medical encounters from the Theater Medical Data Store [TMDS] and excludes 4,358 deployers who had at least one TBI-related medical encounter any time prior to OEF/OIF).

Deep vein thrombophlebitis/pulmonary embolus (ICD-9: 415.1, 451.1, 451.81, 451.83, 451.89, 453.2, 453.40 - 453.42 and 453.8)[b]

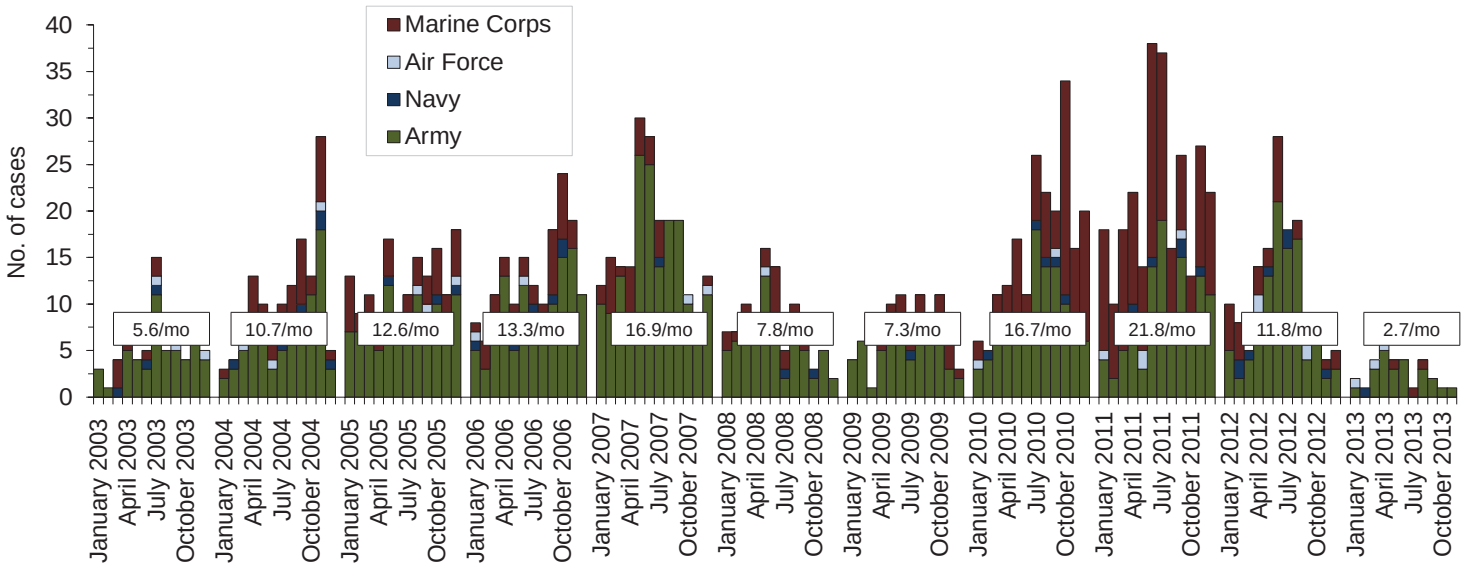


Reference: Isenbarger DW, Atwood JE, Scott PT, et al. Venous thromboembolism among United States soldiers deployed to Southwest Asia. *Thromb Res*. 2006;117(4):379-83.

[b]One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 90 days of returning from OEF/OIF.

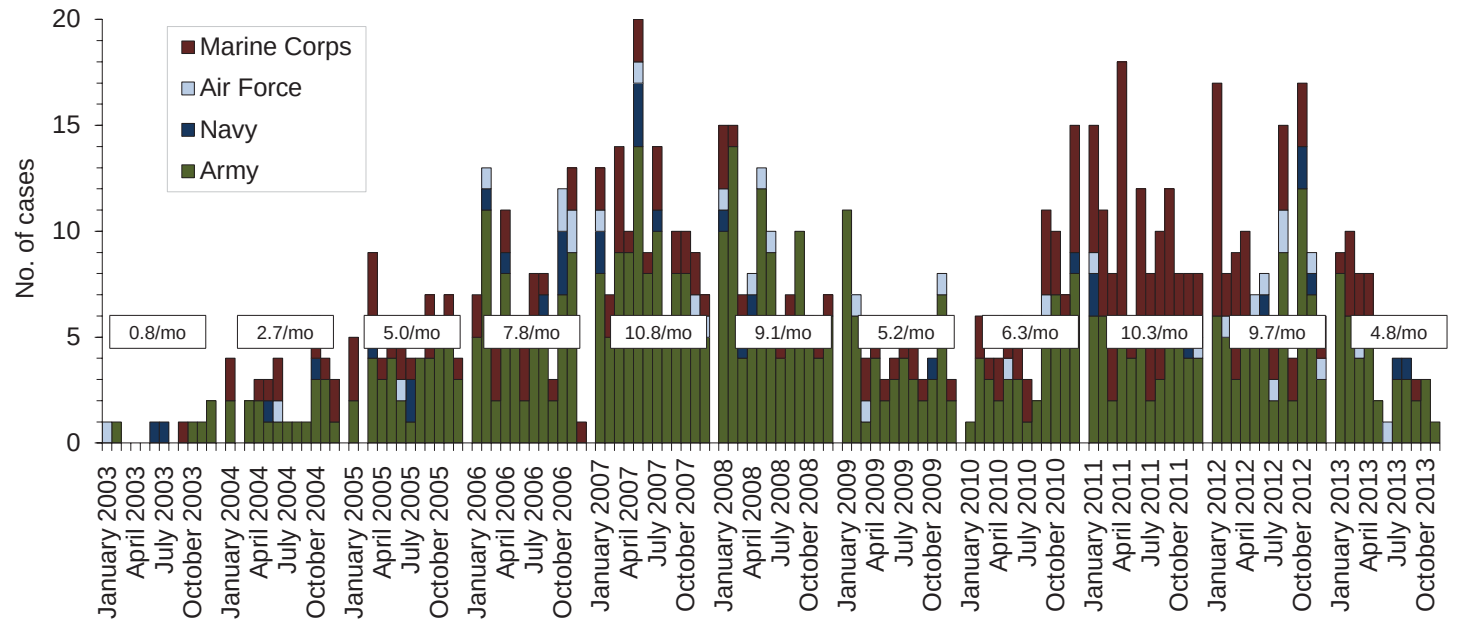
Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003-November 2013 (data as of 19 December 2013)

Amputations (ICD-9-CM: 887, 896, 897, V49.6 except V49.61-V49.62, V49.7 except V49.71-V49.72, PR 84.0-PR 84.1, except PR 84.01-PR 84.02 and PR 84.11)[a]



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: amputations. Amputations of lower and upper extremities, U.S. Armed Forces, 1990-2004. *MSMR*. Jan 2005;11(1):2-6.
[a]Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 365 days of returning from OEF/OIF/OND.

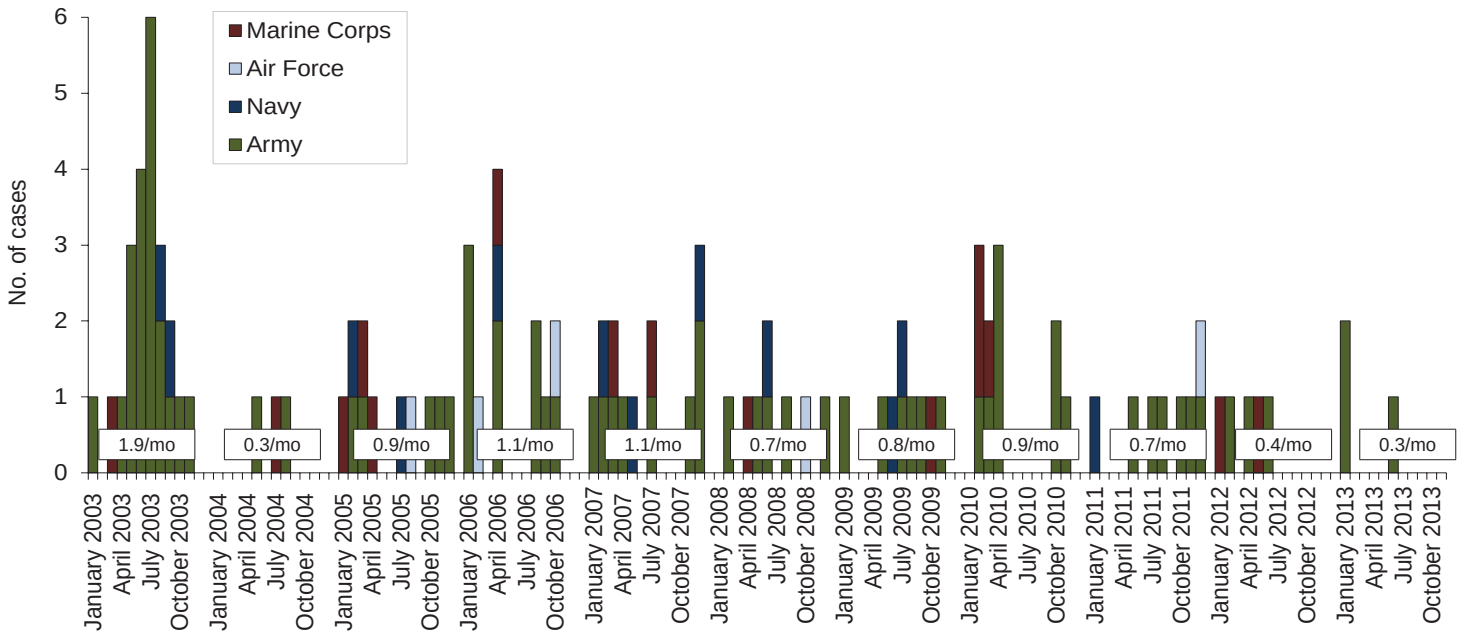
Heterotopic ossification (ICD-9: 728.12, 728.13, 728.19)[b]



Reference: Army Medical Surveillance Activity. Heterotopic ossification, active components, U.S. Armed Forces, 2002-2007. *MSMR*. Aug 2007; 14(5):7-9.
[b]One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 365 days of returning from OEF/OIF/OND.

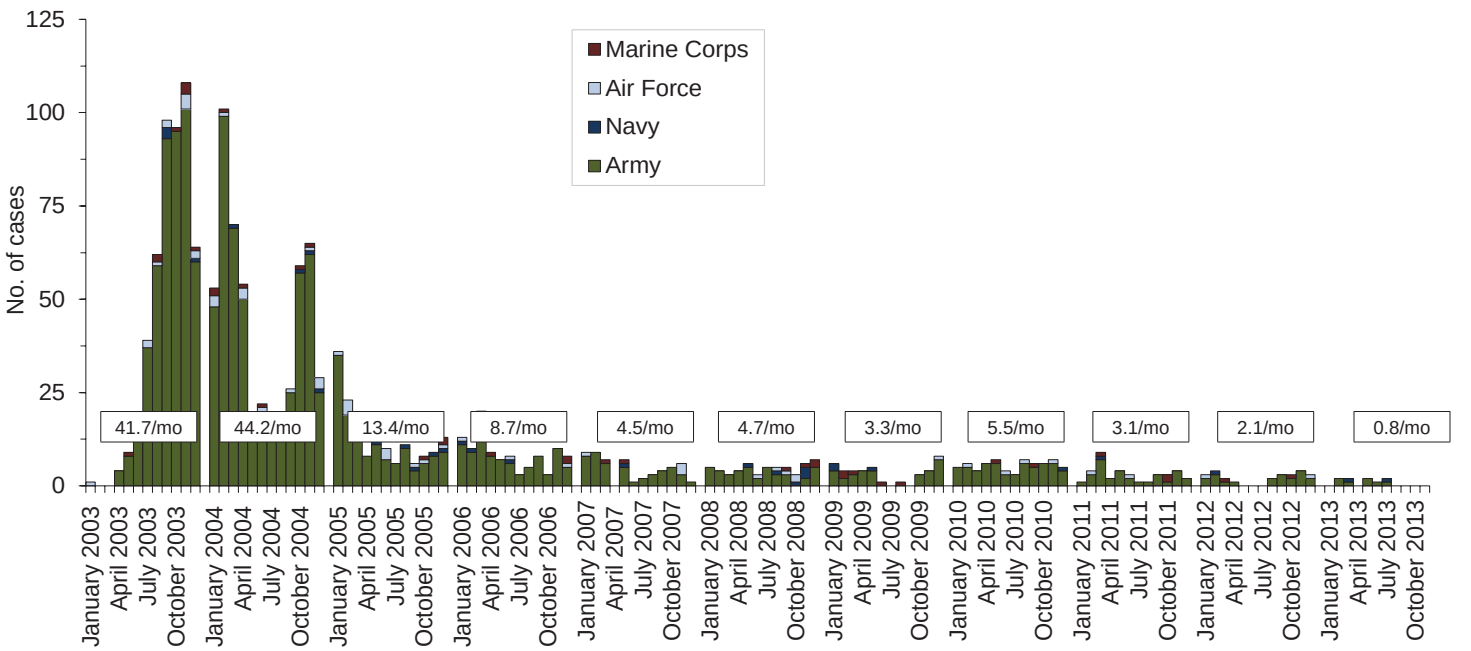
Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003-November 2013 (data as of 19 December 2013)

Severe acute pneumonia (ICD-9: 518.81, 518.82, 480-487, 786.09)[a]



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: severe acute pneumonia. Hospitalizations for acute respiratory failure (ARF)/acute respiratory distress syndrome (ARDS) among participants in Operation Enduring Freedom/Operation Iraqi Freedom, active components, U.S. Armed Forces, January 2003-November 2004. MSMR. Nov/Dec 2004;10(6):6-7.
[a]Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 30 days of returning from OEF/OIF/OND.

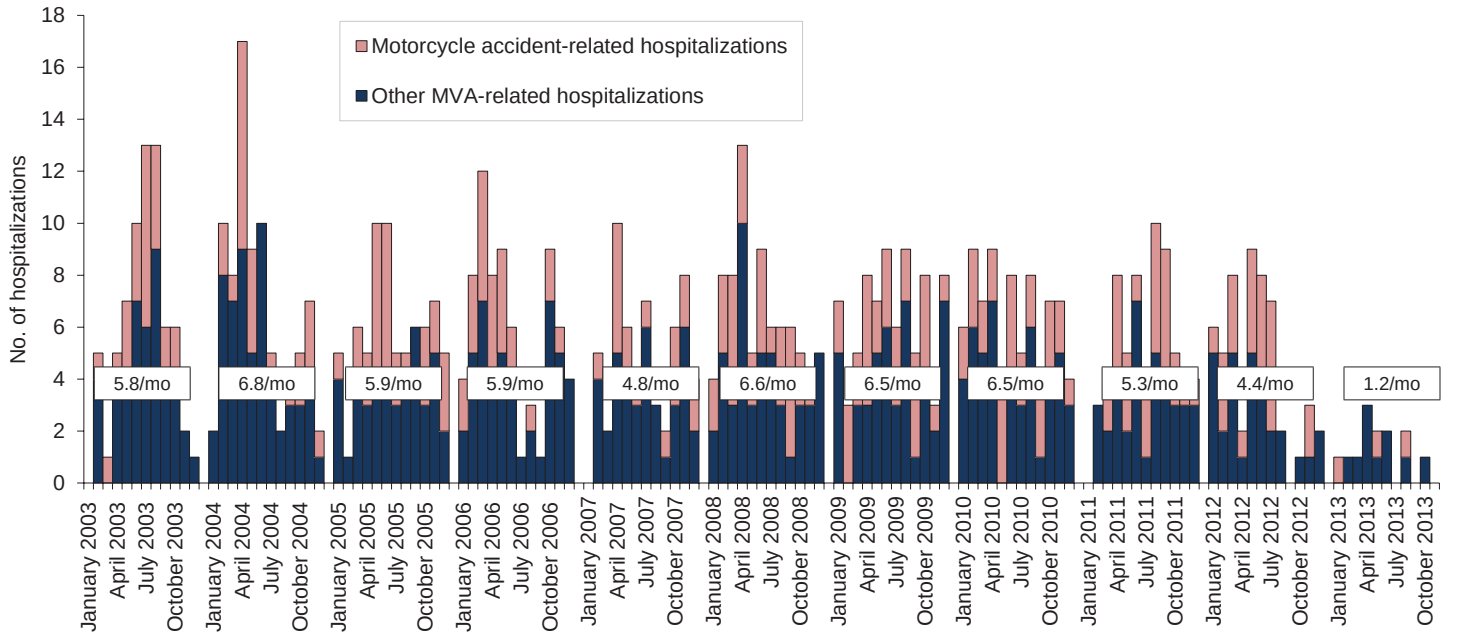
Leishmaniasis (ICD-9: 085.0 to 085.9)[b]



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: leishmaniasis. Leishmaniasis among U.S. Armed Forces, January 2003-November 2004. MSMR. Nov/Dec 2004;10(6):2-4.
[b]Indicator diagnosis (one per individual) during a hospitalization, ambulatory visit, and/or from a notifiable medical event during/after service in OEF/OIF/OND.

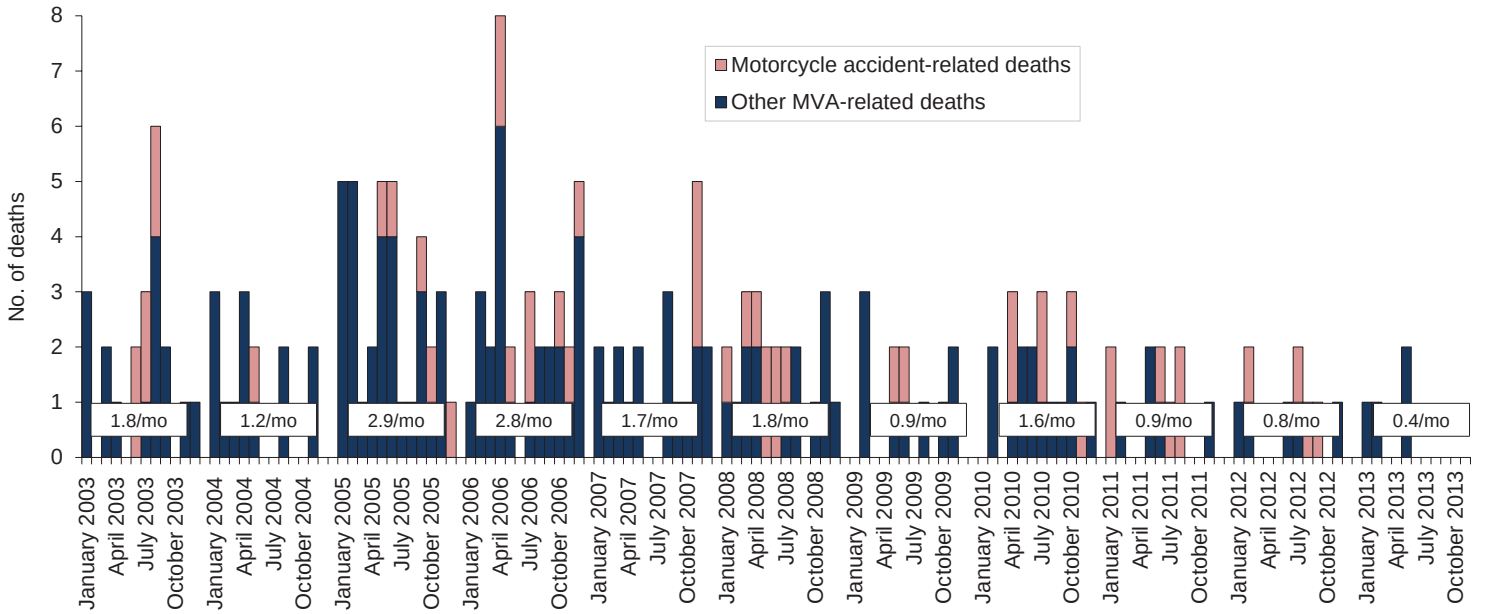
Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003-November 2013 (data as of 18 December 2013)

Hospitalizations outside of the operational theater for motor vehicle accidents occurring in non-military vehicles (ICD-9-CM: E810-E825; NATO Standard Agreement 2050 (STANAG): 100-106, 107-109, 120-126, 127-129)



Note: Hospitalization (one per individual) while deployed to/within 90 days of returning from OEF/OIF/OND. Excludes accidents involving military-owned/special use motor vehicles. Excludes individuals medically evacuated from CENTCOM and/or hospitalized in Landstuhl, Germany within 10 days of another motor vehicle accident-related hospitalization.

Deaths following motor vehicle accidents occurring in non-military vehicles and outside of the operational theater (per the DoD Medical Mortality Registry)



Reference: Armed Forces Health Surveillance Center. Motor vehicle-related deaths, U.S. Armed Forces, 2010. *Medical Surveillance Monthly Report (MSMR)*. Mar 11;17(3):2-6.
Note: Death while deployed to/within 90 days of returning from OEF/OIF/OND. Excludes accidents involving military-owned/special use motor vehicles. Excludes individuals medically evacuated from CENTCOM and/or hospitalized in Landstuhl, Germany within 10 days prior to death.

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